NEC

User's Manual

8-bit 78K0 ZigBee™ Development Platforms

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Chapter 1 78K0 ZigBee Development Solutions

1.1 TK-78K0/KF2+UZ

The TK-78K0/KF2+UZ is the NEC Electronics 8-bit starter kit specifically designed for the development of wireless networking applications. The above platform can be used to design and develop a broad range of wireless networks from simple peer to peer to full mesh networking incorporating all of the features of a fully compliant ZigBee™ network.

1.2 Features

Features of the TK-78K0/KF2+UZ MCU board are as follows.

- The evaluation board uses the NEC Electronics 8-bit single chip microcontroller (μPD78F0547D).
- All of ROM, RAM and a multitude of peripherals are efficiently built in one chip on a single board.
- High-speed operation with a16 MHz clock.
- Sub-clock 32.768 KHz standard equipment
- 128 Kbytes Flash memory is built into MCU chip.
- A high-speed RAM:1024 Bytes and an additional 6144 Bytes of RAM.
- Hardware is ready to accommodate 2.4GHz transceiver chip UZ2400 (IEEE802.15.4 ZigBee™ compliant wireless personal area network) made by Uniband Electronic Corporation *http://www.ubec.com.tw/index.html*
- Attached antenna Titanis made by Gigaant *http://www.gigaant.com/*
- A maximum of 17 I/O ports are used, with an on-board temperature sensor for applications development. (S-8120C made by SII *http://www.sii.co.jp/*)
- Debugging using the on-board on-chip debug function can be.
- USB or battery powered with a compact form factor of 70 mm × 60 mm.

Please inquire direct to the parts maker about specification of UZ2400 chip, antenna and temperature sensor.

1.3 System Requirements

Host PC A PC supporting Windows 2000 or Windows XP for the IAR Systems Embedded Workbench Kickstart edition and the 78K0 ZigBee™ development platforms. Pentium 200 MHz minimum, 128 MB of RAM, 256 colour display (1024 x 768), mouse, CD ROM drive and 200 Mbytes of disk space are required to install the tool packages.

Host Interface USB interface that enables communication based on USB (Version 1.1 or later).

Package Contents Please verify that you have received all of the parts listed in the package contents list attached to the 78K0 ZigBee™ platforms (varies with development platform purchased). If any parts are missing or seem to be damaged please contact the dealer from whom you received your 78K0 ZigBee™ development platform.

Note Updates for the IAR Embedded workbench for 78K, documentation and/or utilities for the 78K0 ZigBee™ platforms if available maybe downloaded from the NEC Electronics web pages at: *http://www.eu.necel.com/updates*

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1.4 System Configuration

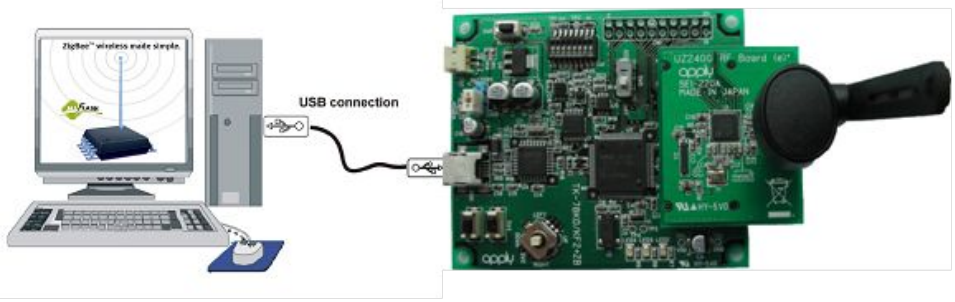


Figure 1-1 System Connection

1.5 78K0 ZigBee™ Development Platforms

There are 3 variants of the 78K0 ZigBee™ Development platforms.

1.5.1 ZigBee™ Starter Kit

This starter kit consists of 2 78K0/KF2+UZ development boards and the IAR software development tools. Also provided are the IEEE 802.15.4 MAC libraries in both banked and non-banked form. The following sample applications are provided:

RF Test program.

Sample 1 Wireless text chat program.

Sample2 Led test using a star network

1.5.2 ZigBee™ Professional Developers Kit

The professional developers kit consists of 4 78K0/KF2+UZ development boards and the IAR software development tools. Also provided are the IEEE 802.15.4 MAC libraries in both banked and non-banked form. The following sample applications are provided:

RF Test program.

Sample 1 Wireless text chat program.

Sample2 Led test using a star network

Also included in the professional developers kit are the following aids for developing full ZigBee™ wireless networks.

30 day software security dongle for the ZigBee™ stack and ZigBee™ Software Developers kit.

Link to secure website for downloading ZigBee™ and SDK.

Flash programming files to allow one of the boards to be utilised as an Air Sniffer (in conjunction with software supplied in the SDK).

1.5.3 ZigBee™ Premium Developers Kit

The premium developers kit consists of 4 78K0/KF2+UZ development boards, 1 78K0 UZ stick and the IAR software development tools. Also provided are the IEEE 802.15.4 MAC libraries in both banked and non-banked form. The following sample applications are provided:

RF Test program.

Sample 1 Wireless text chat program.

Sample2 Led test using a star network

Also included in the professional developers kit are the following aids for developing full ZigBee™ wireless networks.

Unlimited software security dongle for the ZigBee™ stack and ZigBee™ Software Developers kit.

Link to secure website for downloading ZigBee™ and SDK.

Flash programming files to allow one of the boards to be utilised as an Air Sniffer (in conjunction with software supplied in the SDK).

Chapter 2 Sample Program Overview

2.1 RF Test Program

The RF test program is a simple program that allows various RF parameters to be configured and test signals generated. The features found in this program can be used to provide the software support functions needed for various test requirements.

In the sample provided a simple terminal program like “Hyperterminal” is required to select the relevant mode of operation. For all “Hyperterminal” please use the following settings and relevant serial port.

Baud Rate	19200
Data bits	8
Parity	N
Stop bits	1
Flow control	None

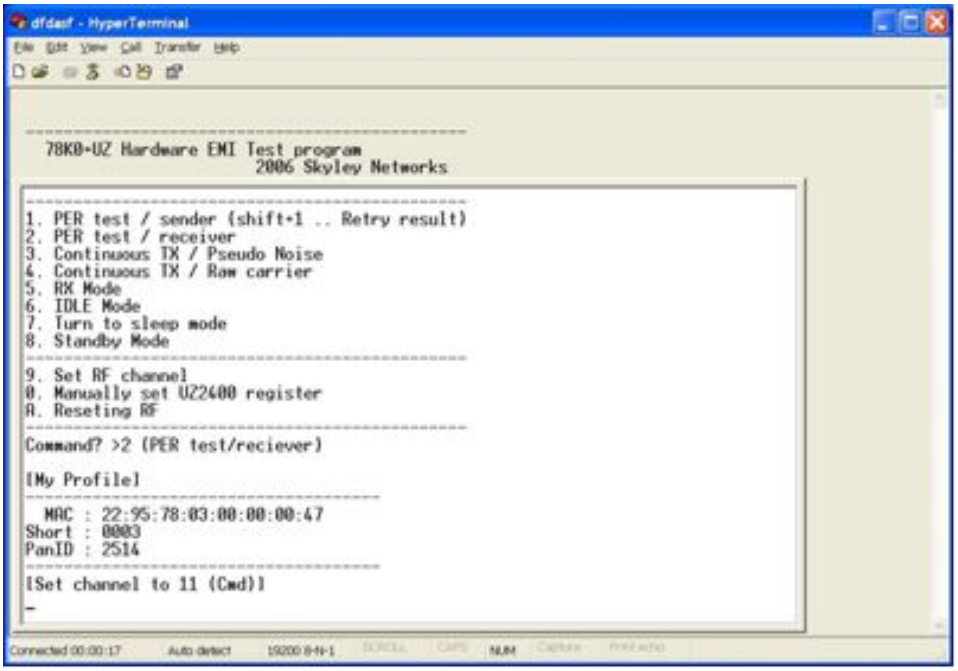

dfdasf - HyperTerminal
File Edit View Call Transfer Help
78K0-UZ Hardware EMI Test program
2006 Skyley Networks
1. PER test / sender (shift-1 .. Retry result)
2. PER test / receiver
3. Continuous TX / Pseudo Noise
4. Continuous TX / Raw carrier
5. RX Mode
6. IDLE Mode
7. Turn to sleep mode
8. Standby Mode
9. Set RF channel
0. Manually set UZ2400 register
A. Reseting RF
Command? >2 (PER test/reciever)
[My Profile]
MAC : 22:95:78:03:00:00:00:47
Short : 0003
PanID : 2514
[Set channel to 11 (Cmd)]
Connected 00:00:17
Auto detect
19200 8-N-1

Figure 2-1 RF Test Menu

As can be seen from the above multiple test modes are available via simple single key operation.

2.2 Sample Program 1 - Wireless Text Chat

In this sample program it is possible to configure 2 or more nodes for a wireless conversation using text.

To demonstrate this program you will again need a simple terminal emulation program like “Hyperterminal” connected to each node on the network.

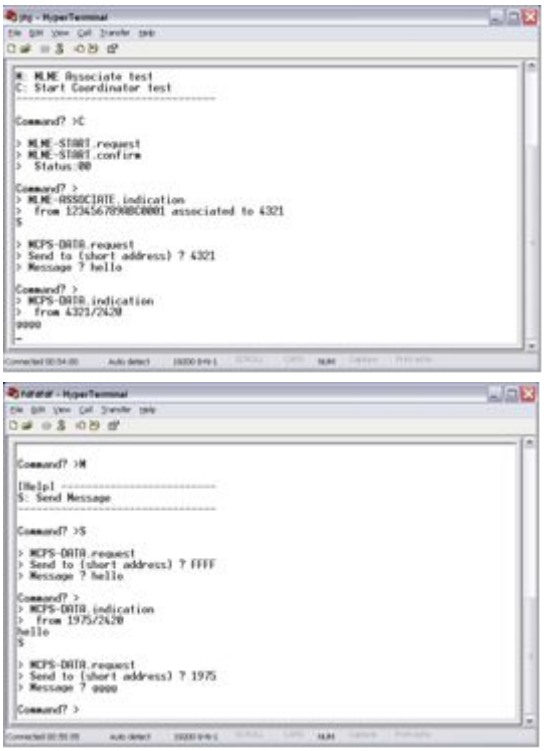


Figure 2-2 RF Test Demonstration

In the above demonstration 1 node is configured as a coordinator and the other nodes associate to this node, when association is complete you send messages between nodes by specifying the short address and text data.

2.3 Sample Program 2 - LED Test Using a Star Network

In this sample program 2 or nodes can form a star network (a star network has a central coordinator with several nodes connecting to the coordinator only).

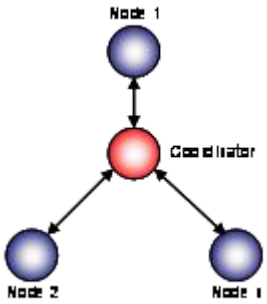


Figure 2-3 Star Network Configuration

To enable 1 module to be the coordinator it necessary to set dip switch SW1 switch 8 to the on position. It is necessary to power cycle the unit or reset the unit as the SW1 switch 8 is only read following a reset.

You must only enable one module to be the coordinator on the network all other modules must be end devices so please ensure that all of the other modules have SW1 switch 8 set to the off position.

To ensure that each end device that joins the network reliably it is necessary to associate on to the network with a different network address for each end device. This is achieved by the following process.
Press the reset switch (SW6) and any of the switch positions of the directional switch (SW2).
Release the reset switch (SW6).
Wait 1 second and then release the directional switch (SW2).

The nodes will then associate to the coordinator and form a star network.
The following table shows how the addresses are allocated depending upon the selection of SW2 following a reset.

Table 2-1 SW2 Address Selection

SW2 Up Position Selected	Default Address + 1
SW2 Centre Position Selected	Default Address + 2
SW2 Left Position Selected	Default Address + 3
SW2 Right Position Selected	Default Address + 4
SW2 Down Position Selected	Default Address + 5

When association is complete pressing SW3 on the end devices will cause LED2 to flash on the coordinator and pressing SW4 on the end devices will cause LED3 to flash on the coordinator.

Note! if SW2 is not active following a reset then all end devices will try and associate using the default address.

It is also possible to connect “Hyperterminal” to the development boards and view the association and data transfer as text messages.

2.4 Programming the Nodes with the Sample Programs

The 78K0/KF2-UZ boards will come pre-programmed with the text chat sample application, in order to demonstrate the additional applications it is required to use the flash programming software supplied.

After installation the PG-FPL3 can be launched from the NEC Tools32 program group. The following screen will appear.

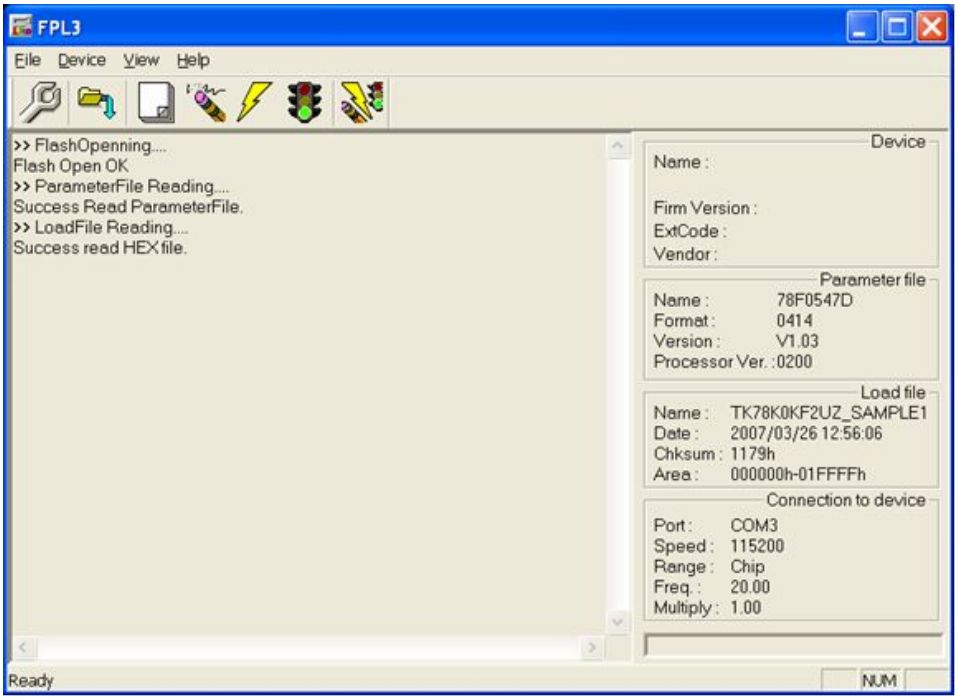


Figure 2-4 PG-FPL3 Main Screen

It is vital to ensure that the correct device parameter file is loaded for the TK-78K0/KF2+UZ board you must select the 78F0547D.PRM file and for the 78K0 UZ Stick you must select the 78F0537D.PRM file.

To select the correct device file click the setup button and the following dialog will appear.

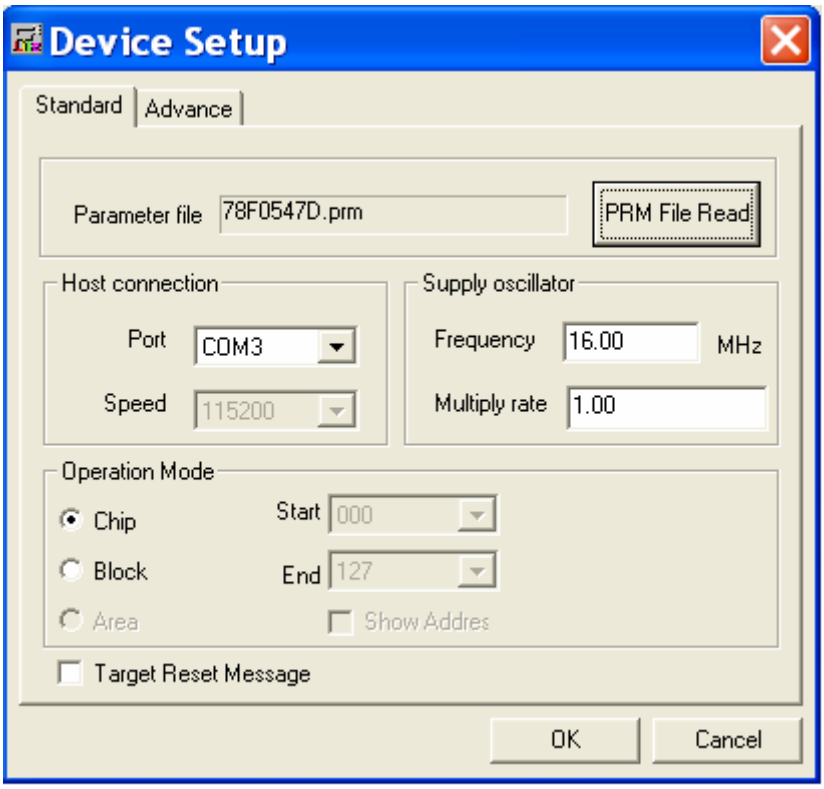


Figure 2-5 PG-FPL3 Setup Screen

Select PRM File Read and choose the correct device file for the relevant hardware. While this dialog is open you can also select the com port that the target is connected to and change the clock frequency to 16.00 MHz (the operating frequency of the 78K0 ZigBee™ development platforms).

The sample programs for the TK-78K0/KF2+UZ and the 78K0 UZ Stick are available in both normal configuration and memory banked configuration, the default location for the sample programs is \TK78K0\SamplePrograms\.

To load a sample program select the file load button the following dialog will appear.

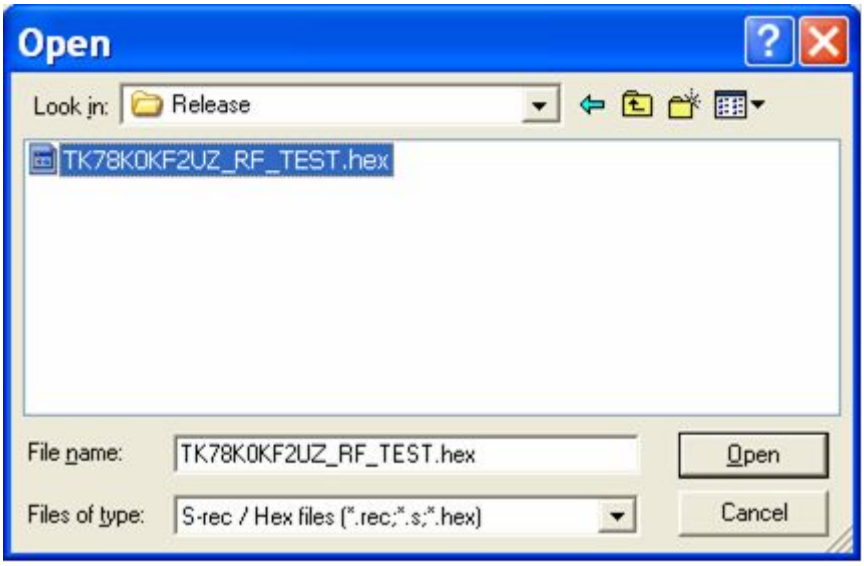


Figure 2-6 PG-FPL3 File Load

Using the drop down list box you can select the relevant sample program.

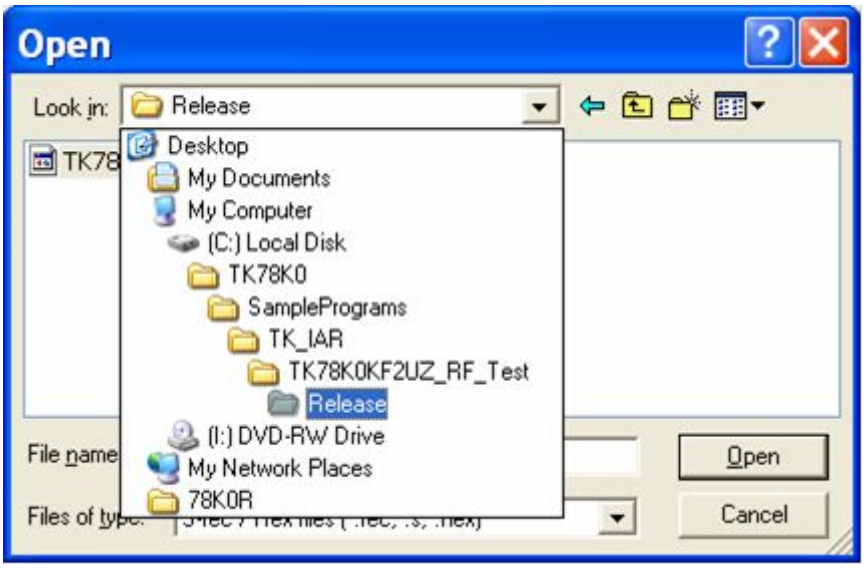


Figure 2-7 PG-FPL3 Select Directory

When the relevant file is loaded you are now ready to re-program the target hardware. To program the hardware first ensure that the unit is configured in flash programming mode (see chapter x) and also ensure that the unit is plugged in to the USB port and the correct COM port assignment is set.

The easiest way to program the unit is to select the auto button this will automatically erase, program and verify that the device has been re-programmed successfully. The following shows the programming screen.

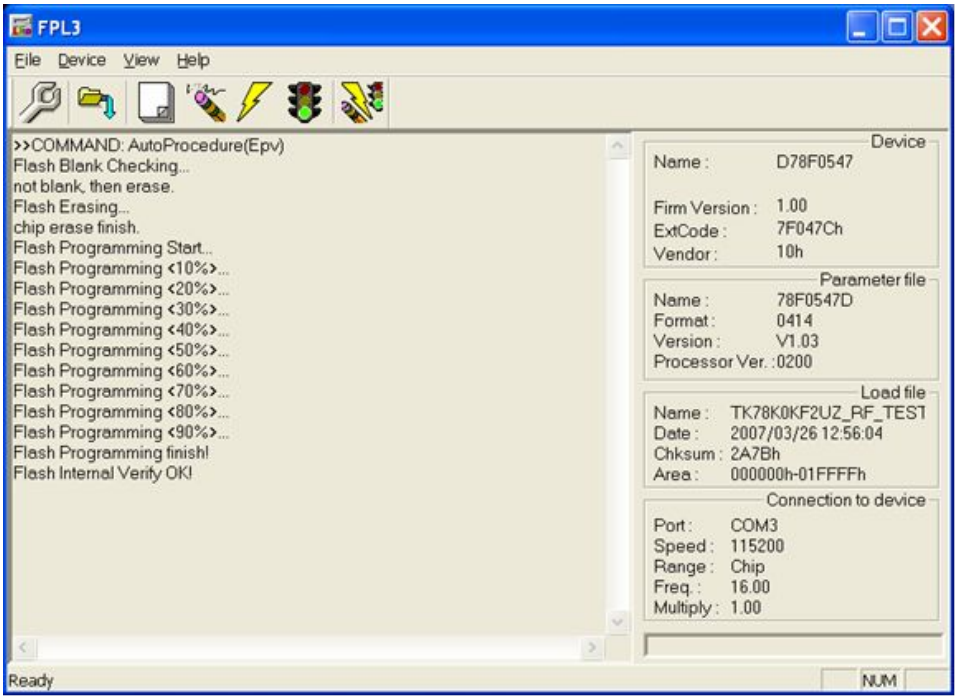


Figure 2-8 PG-FPL3 Flash Programming

You are now ready to test the relevant sample application.

Chapter 3 Hardware Specification TK-78K0/KF2 +UZ

MCU	μPD78F0547DGK
Operation frequency	16 MHz Operation (Sub-clock:32.768 KHz)
RF transceiver	UZ2400 RF Board
Interface	USB (Mini B connector)
	RF board connector
	Connector of board in surrounding (CN1: not mounted)
	Connector of battery (9.0 V - 6.5 V)
Operation voltage	5.0 V (Supply from USB)
	9.0 V (Supply from a battery, Min.6.5 V)

3.1 Terminal List

Terminal tables of CN1, CN3 and CN4 of TK-78K0/KF2+UZ MCU board.

CN1 terminal list (FFC-20BMEP1 [not mounted] by HONDA CONNECTORS)

Table 3-1 CN1

CN1	Signal name	Terminal MCU name at connection destination	Notes
1	VDD	VDD	+3.3V
2	P10	P10/SCK10/TxD0	
3	P11	P11/SI10/RxD0	
4	P12	P12/SO10	
5	P15	P15/TOH0	
6	P16	P16/TOH1/INTP5	
7	P17	P17/TI50/TO50	
8	P24	P24/ANI4	
9	P25	P25/ANI5	
10	P26	P26/ANI6	
11	P27	P27/ANI7	
12	P33	P33/TI51/TO51/INTP4	
13	P60	P60/SCL0	
14	P61	P61/SDA0	
15	P62	P62/EXSCL0	
16	P120	P120/INTP0/EXLVI	
17	GND	GND	
18	P140	P140/PCL/INTP6	
19	GND	GND	
20	P141	P141/BUZ/BUSY0/INTP7	

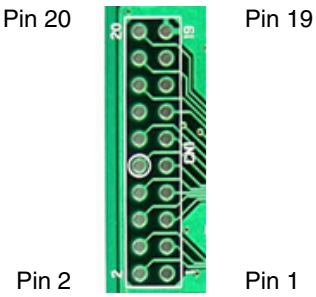


Figure 3-1 CN1 Pin Configuration

CN3 terminal list (TFM-110-02-S-D-A-K-TR [not mounted by SAMTEC])

Table 3-2 CN3

CN3	Signal name	Terminal MCU name	Notes
1	GND	GND	
2			N.C.
3	VREG_EN	P50	Output from MCU
4			N.C.
5	RESn	P51	Output from MCU
6	FIFO	P33/TI51/TO50/INTP4	Input to MCU
7			N.C.
8	FIFOP	P52	Input to MCU
9			N.C.
10	CCA	P53	Input to MCU
11			N.C.
12	SFD	P06/TI011/TO01	Input to MCU
13			N.C.
14	CSn	P43	Output from MCU
15			N.C.
16	SCLK	P04/SCK11	Output from MCU
17			N.C.
18	SI	P02/SO11	Output from MCU
19	GND	GND	
20	SO	P03/SI11	Input to MCU

CN4 terminal list (TFM-110-02-S-D-A-K-TR [not mounted by SAMTEC])

Table 3-3 CN4

CN4	Signal name	Terminal MCU name	Notes
1	TP2		
2	GND	GND	
3	TP2		
4	GND	GND	
5	TP2		

CN4	Signal name	Terminal MCU name	Notes
6	GND	GND	
7	3.3V		
8	GND	GND	
9	3.3V		
10	GND	GND	
11	TP3		
12	GND	GND	
13	TP4		
14	GND	GND	
15			N.C.
16	GND	GND	
17			N.C.
18	GND	GND	
19			N.C.
20	GND	GND	

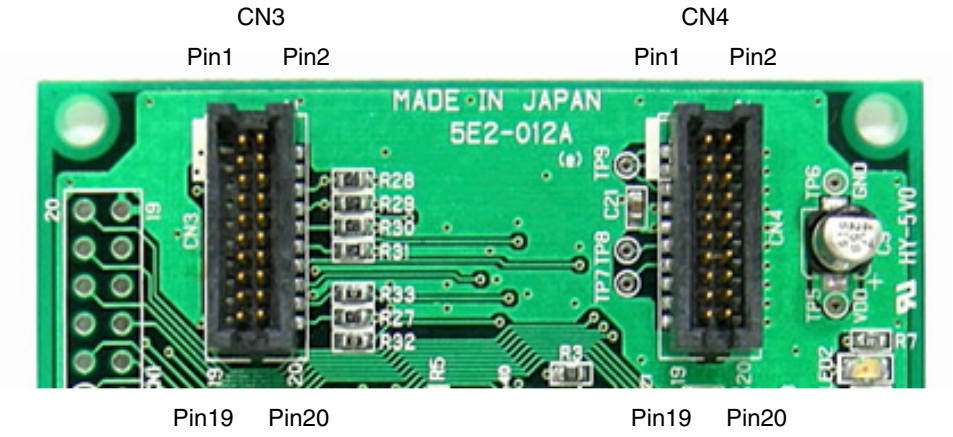


Figure 3-2 CN3 - CN4

3.2 Switches and LEDs

3.2.1 SW1, SW5, JP1

Bits 1-5 of SW1 is a Dip switch that is used to set the operational mode.
SW5 is a slide switch to select an operation mode.
JP1 is a jumper to select a power source.

3.2.2 Flash Programming Mode

Flash EEPROM on the 78K0/KF2+ZB MCU can be programmed using the attached software “PG-FPL3” in your PC, which is connected to the MCU board via USB cable, if the following switch and jumper setting is made.

Table 3-4 Flash Programming Mode

SW1	Bit 1	ON
	Bit 2	ON
	Bit 3	OFF
	Bit 4	OFF
	Bit 5	OFF
SW5		UART
JP1		USB (1-2pin short)

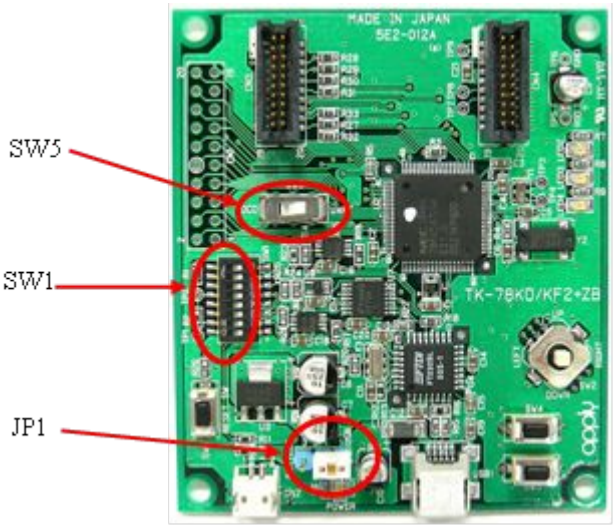


Figure 3-3 Configuration Switches

3.2.3 On-chip Debug Mode

The following setting activates the On-chip debug functions on the MCU.

Table 3-5 On-chip Debug Mode

SW1	Bit 1	ON
	Bit 2	ON
	Bit 3	ON
	Bit 4	ON
	Bit 5	ON
SW5		OCD
JP1		USB (1-2pin short)

3.2.4 Normal Operation Mode

Please change to the following settings when you execute the program normally.

Table 3-6 Normal Operation Mode Settings

SW1	Bit 1	OFF
	Bit 2	OFF
	Bit 3	OFF

	Bit 4	OFF
	Bit 5	OFF
SW5		UART
JP1		see below

Selection of power source by JP1

Table 3-7 Power Source Selection

USB Power	USB (1-2pin short)
Battery	CN2 (2-3pin short)

3.2.5 General Purpose Port Setting

Bits 6-8 of SW1 are connected to general purpose I/O ports.
If the relative switch is active then the I/O port is pulled low, if the switch is open then turn on pull-up resistor (PU0).
For more detail of the pull-up resistor, please refer to the User's manual of the μPD78F0547 MCU.

Table 3-8 General Purpose Switch Setting

SW1	Signal name	Terminal MCU Name	Notes
Bit 6	P00	P00/TI000	
Bit 7	P01	P01/TI010/TO00	
Bit 8	P05	P05/TI001/SSI11	

3.3 SW2

SW2 is a 4 directional switch with a central push. If it is directed or pushed, the relevant input is set to GND. Otherwise the circuit is open. Therefore set the on-chip pull-up resistors (PU7) during initializing routine of your program code.

For more detail, please refer to the User's manual of the μPD78F0547 MCU.

SW2 terminal list (ALPS SKRHADE010)

Table 3-9 SW2 Selection

SW2	Signal name	Terminal MCU name	Notes
1	P72	P72/KR2	UP
2	P73	P73/KR3	CENTER PUSH
3	P74	P74/KR4	LEFT
4	P75	P75/KR5	RIGHT
5	GND	GND	
6	P76	P76/KR6	DOWN

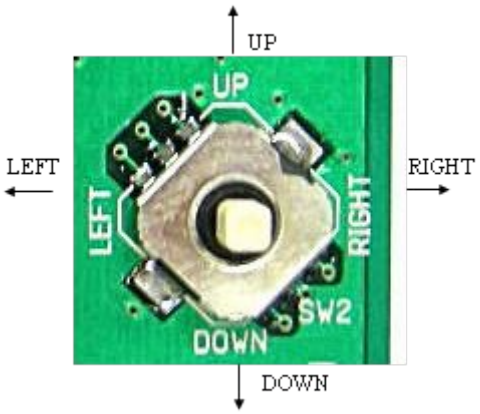


Figure 3-4 SW2 Directional Switch

3.4 SW3, SW4

SW3 and SW4 are tact switches. The port inputs are short-circuited to ground, while they are being pushed, and kept open otherwise. Therefore set the on-chip pull-up resistors(PU7) during initializing routine of your program code.

For more detail, please refer to the User's manual of the μPD78F0547 MCU.

SW3 and SW4 terminal list (ALPS SKQMBBE010)

Table 3-10 Sw3 and SW4 Settings

	Signal name	Terminal MCU name	Notes
SW3	P70	P70/KR0	
SW4	P71	P71/KR1	

Figure 3-5 SW3 and SW4

SW6 is the reset switch. MCU can be reset by pushing this switch.

Figure 3-6 SW6 Reset Switch

'Power LED'. LED1 is activated when the power supply is turned on.

Figure 3-7 Power LED

3.5 LED2, LED3 and LED4

LED2, LED3, and LED4 are available for applications. To turn the LED on, please set the relevant output port LOW.

LED2, LED3 and LED4 Terminal list (STANLEY ELECTRIC PG1111C)

Table 3-11 LED Setting

	Signal name	Terminal MCU name	Notes
LED2	P40	P40	
LED3	P41	P41	
LED4	P42	P42	

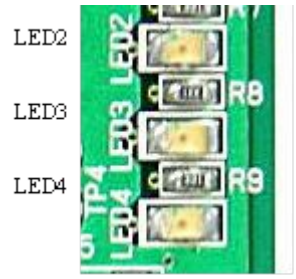


Figure 3-8 LED Identification

3.6 Power Supply

There are two choices to supply power to the board, USB or a 006P battery via CN2. Please refer to 2.1.3 JP1 for the jumper setting.
Please replace the battery with a new one, if the voltage level goes down to 6.5 V.

Below the voltage level of 6.5V, functions of the board are not guaranteed. The battery voltage can be checked at the port as shown below.

Table 3-12 Battery Monitoring

Signal Name	Terminal MCU name at connection destination	Notes
BT_MONI	P20/ANI0	33.8% of the battery output is available at ANI0. For instance, If the battery level is 9 V, the level of the BT_MONI = 0.338 × 9.0 V = 3.042 V If the battery level is 6.5 V, the level of the BT_MONI = 0.338 × 6.5 V = 2.197 V

Chapter 4 TK-78K0/KF2+UZ Data

4.1 Parts Layout

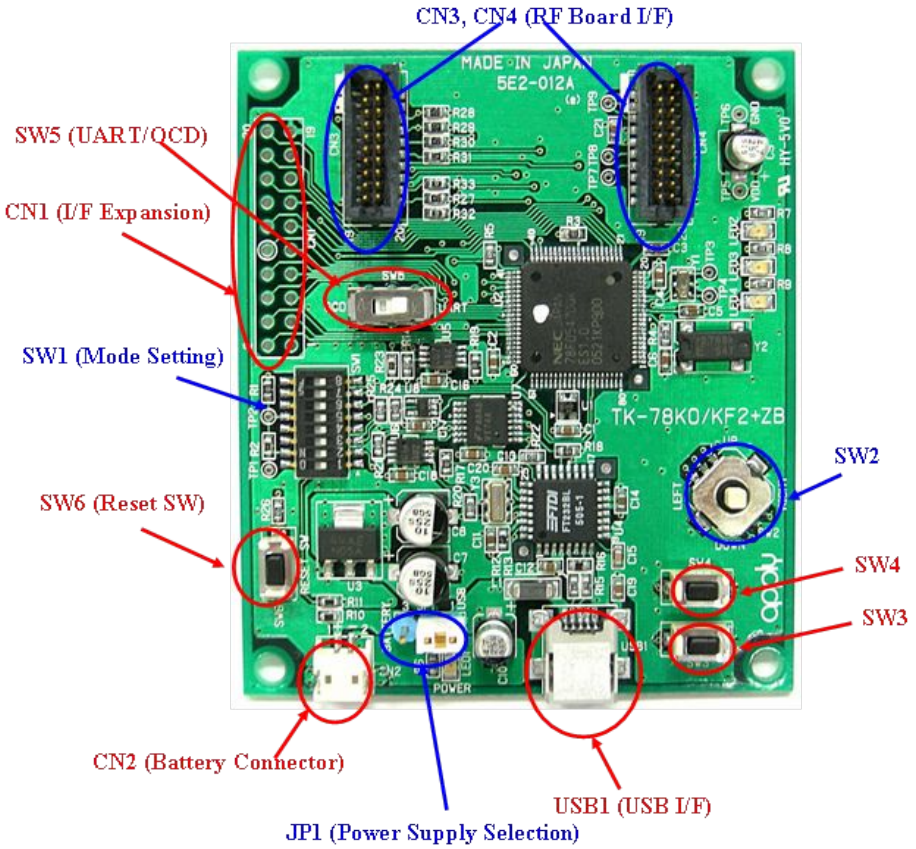


Figure 4-1 TK-78K0/KF2 Parts Layout

4.2 RF Board Connection Figure

Figure 4-2 RF Connection

Chapter 5 Hardware Installation 78K0 UZ Stick

The 78K0 UZ stick is an additional module based on the NEC 78K0/KE2 microcontroller. This module can be used as either a network node or a dedicated hardware module for interfacing to the Air Sniffer application (part of the ZigBee™ SDK) depending upon the flash program loaded on to the module.

Features of the 78K0 UZ stick include:

- Hardware is ready to accommodate IEEE 802.15.4/ZigBee™ compliant wireless personal area network with 8 bit single chip MCU 78K0/KE2, μPD78F0537DGA, and 2.4 GHz transceiver UZ2400
- Object code of IEEE 802.15.4 PHY/MAC is included in the kit and possible to utilize as a library.
- 128 Kbytes of Flash EEPROM, available on chip in the 78K0/KE2 MCU, is programmable from PC via USB connection without any additional Flash programming hardware. Flash programming utility, PG-FPL3, which works on MS Windows in your PC, is included in the kit.
- Debugging of the program requires an optional connector, SICA2P20S, an additional adaptor, SICA10I2P, and a MINICUBE emulator, QB-78K0MINI or QB-MINI2.
- USB connection can be utilized not only for Flash programming, but also for user applications and power supply.
- Real time clock is available on the board.
- In addition to the USB connector, one serial I/O port, UART or CSI, one interrupt input port, and three analogue input ports are available in the expansion connector.
- The expansion connector also provides with a connection to a 006P battery. Power source can be selectable between USB or a battery by a switch.
- Three orange LEDs are available on board for applications, in addition to one green LED for power indication.
- The size of the module is 82 x 23 mm.

5.1 Hardware Overview

MCU	UD78F0537DGA with 128 KB Flash EEPROM and 7 KB RAM
Clock	16MHz main, and 32.768KHz sub
RF transceiver	UZ2400
Interfaces	USB connector (Type A) Expansion interface Option: MINICUBE connector (CN1)
Power supply	5.0 V by USB, or 4.75 - 10.0 V by a battery

5.2 Block Diagram

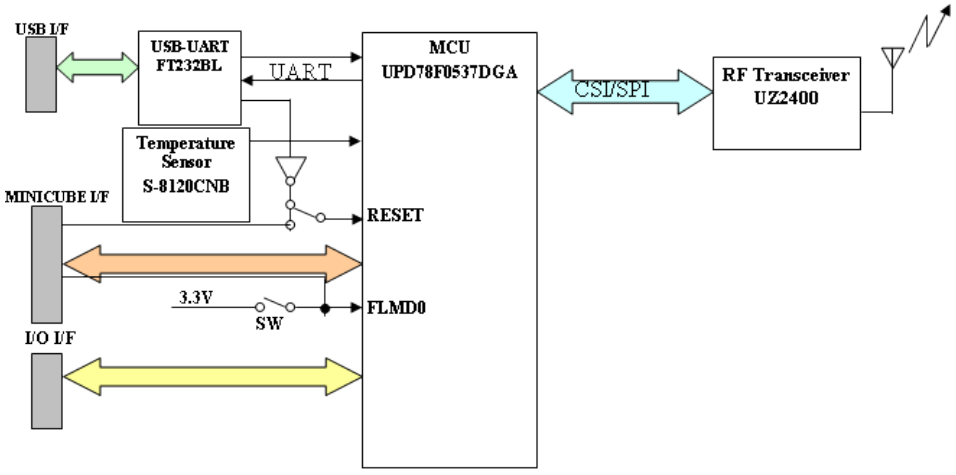


Figure 5-1 Block Diagram 78K0 UZ Stick

Interface Connection

CN1 Minicube/Minicube 2

Table 5-1 CN1 78K0 UZ Stick

CN1	Name	Connection to MCU	Notes
1	RESET_IN	Pull-up with 10 K Ohm	
2	REST_OUT	RESET	
3	FLMD0	FLMD0	Programming Mode
4	VDD_IN	VDD (3.3V)	Regulated
5	X2	P32/INTP3/OCD1B	OCDX2
6	GND	GND	
7	X1	P31/INTP2/OCD1A	OCDX1
8	GND	GND	
9	-	N.C.	
10	5V_CHK	N.C.	
11	-	N.C.	
12	-	N.C.	
13	-	N.C.	
14	-	N.C.	
15	-	N.C.	
16	-	N.C.	
17	-	N.C.	
18	-	N.C.	
19	-	N.C.	
20	-	N.C.	

CN1: Tokyo Eletech SICA2P20S (Not fitted)

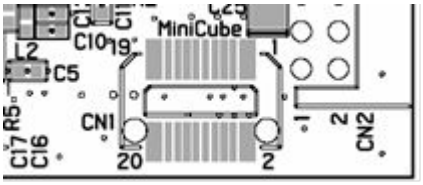


Figure 5-2 Location of CN1

Expansion Interface: CN2

CN2: Hirose DF11-10DP-2DS

Table 5-2 CN2 78K0 UZ Stick

CN2	Name	Connection to MCU	Notes
1	GND	GND	Battery GND
2	VBAT	4.75V - 10.0V	From battery
3	P10	P10/SCK10/TXD0	
4	P11	P11/SI10/RXD0	
5	P140	P140/PCL/INTP6	
6	P12	P12/SO10	
7	P24	P24/ANI4	
8	P25	P25/ANI5	
9	P26	P26/ANI6	
10	GND	GND	

Location of CN2: TOP VIEW

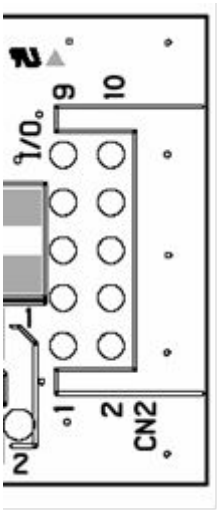


Figure 5-3 CN2 Location

Chapter 6 Switches and LEDs

6.1 SW1 - FLMD0

Programming mode selection for Flash EEPROM on the MCU.

Setting of SW1: FLMD0

Normal Mode	L
Flash Programming Mode	H

Figure 6-1 SW1 Top View

6.2 SW2 - Power

Selection of power source: USB power or battery at CN2

Setting of SW2

USB Power	USB
CN2: Expansion I/F	BAT

Figure 6-2 SW2 Top View

6.3 LED1 - Power Indication

LED1 is a green LED to indicate the availability of power.

LED1 status

Table 6-1 Power LED 78K0 UZ Stick

Status	LED
Power ON	Green
Power OFF	Off

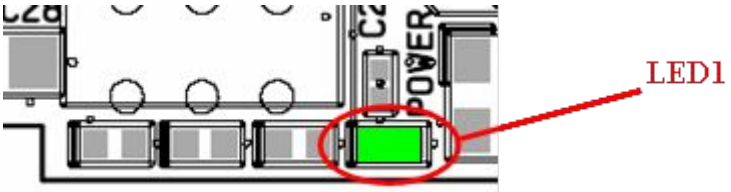


Figure 6-3 LED1 Top View

6.4 LED2, LED3 and LED4

LED2, LED3, and LED4 are for application. They emit orange by setting the port output of P40, P41, or P40 of the MCU low, respectively.

Table 6-2 LED Allocation 78K0 UZ Stick

	Name	MCU Pin	Port Level
LED2	P40	P40/AD0	LOW for orange HIGH for off
LED3	P41	P41/AD1	LOW for orange HIGH for off
LED4	P42	P42/AD2	LOW for orange HIGH for off

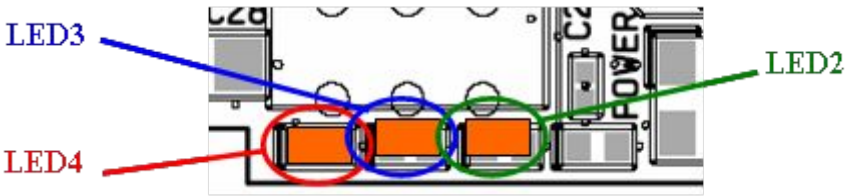


Figure 6-4 LED2, LED3, and LED4 Top View

Chapter 7 ZigBee™ Development Platforms, Installation and Operation

The IAR Embedded Workbench including the C-SPY debugger allows to build and download application programs to the ZigBee™ development platforms!. As communication interface between the PC host system and the ZigBee™ development platforms! board is USB, a USB interface line is needed. Before you can download and run a program, software and hardware must be installed properly.

CD ROM contents:

- IAR Embedded Workbench for 78K0 Kickstart version
- IEEE 802.15.4 MAC library
- Sample Programs
- Documentation

7.1 Hardware Installation

After unpacking ZigBee™ development platforms!, connect the board to your host computer using the provided USB interface cable. When ZigBee™ development platforms! is connected, the USB driver needs to be installed on the host machine. Please refer to the following section.

7.2 Software Installation

The ZigBee™ development platforms! package comes with the following software demo packages:

- IAR Systems Embedded Workbench for 78K0/78K0S/78K0R, including C compiler, assembler, linker, librarian and IAR C-SPY debugger / simulator
- Sample programs

The IAR Systems Embedded Workbench must be installed on your PC. For detailed installation hints, refer to the following chapters and to the corresponding documentation of the IAR Embedded Workbench.

IAR Systems Embedded Workbench for 78K0/78K0S/78K0R installation

To install the IAR Systems Embedded Workbench for 78K0/K0S/K0R including C-SPY debugger / simulator, select the SETUP program in the directory \IAR Embedded Workbench 78K\ew78k\ of the CDROM. The setup dialogues will guide you through the installation process.

7.3 Sample Program Installation

To install the sample/demonstration program for the ZigBee™ development platforms! board select the SETUP program in the directory \TK78K0

\SamplePrograms\ of the CDROM. The setup dialogues will guide you through the installation process.

7.4 USB Driver Installation

In order to use the ZigBee™ development platforms! board for On-Chip debugging or FLASH programming, the USB driver needs to be installed on the host machine. Install the driver according to the following procedure:

- Installation on Windows 2000
- Installation on Windows XP

7.4.1 Installation on Windows 2000

When the *ZigBee™ development platforms!* board is connected with the host machine, the board is recognized by Plug and Play, and the wizard for finding new hardware is started. Click Next >

Found New Hardware Wizard
Welcome to the Found New Hardware Wizard
This wizard helps you install a device driver for a hardware device.
To continue, click Next.
< Back
Next >
Cancel

Figure 7-1 Found New Hardware Wizard (Widows 2000)

The window below is displayed. So, check that "Search for a suitable driver ..." is selected, then click Next >

Found New Hardware Wizard
Install Hardware Device Drivers
A device driver is a software program that enables a hardware device to work with an operating system.
This wizard will complete the installation for this device:
USB <-> Serial
A device driver is a software program that makes a hardware device work. Windows needs driver files for your new device. To locate driver files and complete the installation click Next.
What do you want the wizard to do?
Search for a suitable driver for my device (recommended)
Display a list of the known drivers for this device so that I can choose a specific driver
< Back
Next >
Cancel

Figure 7-2 Search Method (Windows 2000)

Check the "Specify a location" check box only, then click Next >

Found New Hardware Wizard
Locate Driver Files
Where do you want Windows to search for driver files?
Search for driver files for the following hardware device:
USB <-> Serial
The wizard searches for suitable drivers in its driver database on your computer and in any of the following optional search locations that you specify.
To start the search, click Next. If you are searching on a floppy disk or CD-ROM drive, insert the floppy disk or CD before clicking Next.
Optional search locations:
Floppy disk drives
CD-ROM drives
Specify a location
Microsoft Windows Update
< Back
Next >
Cancel

Figure 7-3 Driver File Location (Windows 2000)

Enter "C:\Program Files\NECTools32\FPL3\DRIVER" in the address bar, then click OK.

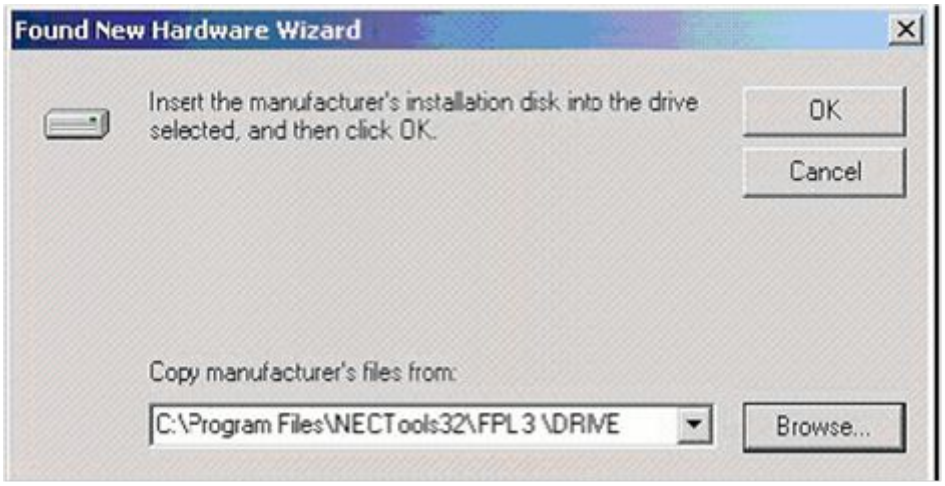


Figure 7-4 Address Location 1 (Windows 2000)

Remark As the installation destination folder enter "new-folder\FPL3\DRIVER". Click Next >

Found New Hardware Wizard
Driver Files Search Results
The wizard has finished searching for driver files for your hardware device.
The wizard found a driver for the following device:
USB <-> Serial
Windows found a driver for this device. To install the driver Windows found, click Next.
c:\program files\nectools32\ fpl3 \driver\ ftdibus.inf
< Back
Next >
Cancel

Figure 7-5 File Location 1 (Windows 2000)

Click Finish to complete the installation of the USB driver.

Found New Hardware Wizard
Completing the Found New Hardware Wizard
USB High Speed Serial Converter
Windows has finished installing the software for this device.
To close this wizard, click Finish.
< Back
Finish
Cancel

Figure 7-6 USB Driver Installation Complete 1 (Windows 2000)

Proceed to the installation of the USB Serial Port driver. Click Next >

Found New Hardware Wizard
Welcome to the Found New Hardware Wizard
This wizard helps you install a device driver for a hardware device.
To continue, click Next.
< Back
Next >
Cancel

Figure 7-7 Found new Hardware Wizard 2 (Windows 2000)

The window below is displayed. So, check that "Search for a suitable driver ..." is selected, then click Next >

Found New Hardware Wizard
Install Hardware Device Drivers
A device driver is a software program that enables a hardware device to work with an operating system.
This wizard will complete the installation for this device:
USB Serial Port
A device driver is a software program that makes a hardware device work. Windows needs driver files for your new device. To locate driver files and complete the installation click Next.
What do you want the wizard to do?
Search for a suitable driver for my device (recommended)
Display a list of the known drivers for this device so that I can choose a specific driver
< Back
Next >
Cancel

Figure 7-8 Search Method 2 (Windows 2000)

Check the "Specify a location" check box only, then click Next >

Found New Hardware Wizard
Install Hardware Device Drivers
A device driver is a software program that enables a hardware device to work with an operating system.
This wizard will complete the installation for this device:
USB Serial Port
A device driver is a software program that makes a hardware device work. Windows needs driver files for your new device. To locate driver files and complete the installation click Next.
What do you want the wizard to do?
Search for a suitable driver for my device (recommended)
Display a list of the known drivers for this device so that I can choose a specific driver
< Back
Next >
Cancel

Figure 7-9 Driver File Location 2 (Windows 2000)

Enter "C:\Program Files\NECTools32\FPL3\DRIVER" in the address bar, then click OK.

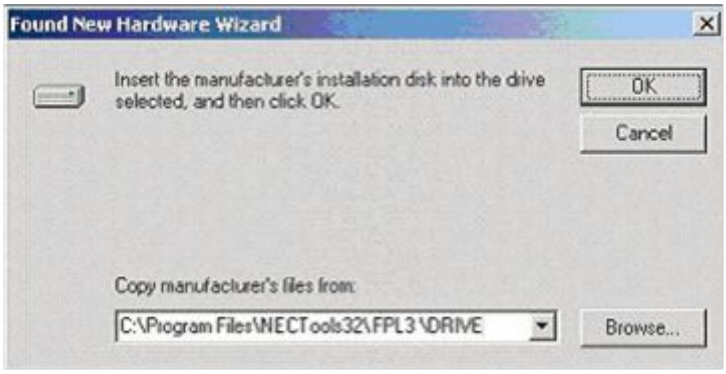


Figure 7-10 Address Specification 2 (Windows 2000)

Remark If the installation destination folder is changed at the time of GUI software installation, enter "new-folder\DRIVER". Click Next >

Found New Hardware Wizard
Driver Files Search Results
The wizard has finished searching for driver files for your hardware device.
The wizard found a driver for the following device:
USB Serial Port
Windows found a driver for this device. To install the driver Windows found, click Next.
c:\program files\nectools32\fpl3\driver\ftdiport.inf
< Back
Next >
Cancel

Figure 7-11 Driver File Search 2 (Windows 2000)

Click Finish to complete the installation of the USB driver.

Found New Hardware Wizard
Completing the Found New Hardware Wizard
USB Serial Port
Windows has finished installing the software for this device.
To close this wizard, click Finish.
< Back
Finish
Cancel

Figure 7-12 USB Driver Complete 2 (Windows 2000)

7.4.2 Installation on Windows XP

When the *ZigBee™ development platforms!* board is connected with the host machine, the board is recognized by Plug and Play, and the wizard for finding new hardware is started. Check that "Install from a list or specific ..." is selected, then click Next >

Found New Hardware Wizard
Welcome to the Found New Hardware Wizard
This wizard helps you install software for:
USB <-> Serial
If your hardware came with an installation CD or floppy disk, insert it now.
What do you want the wizard to do?
Install the software automatically (Recommended)
Install from a list or specific location (Advanced)
Click Next to continue.
< Back
Next >
Cancel

Figure 7-13 Found New Hardware Wizard 1 (Windows XP)

Check that "Search for the best driver in these locations." is selected. Check the "Include this location in the search:" check box and enter "C:\Program Files \NECTools32\FPL3\DRIVER" in the address bar, then click Next >

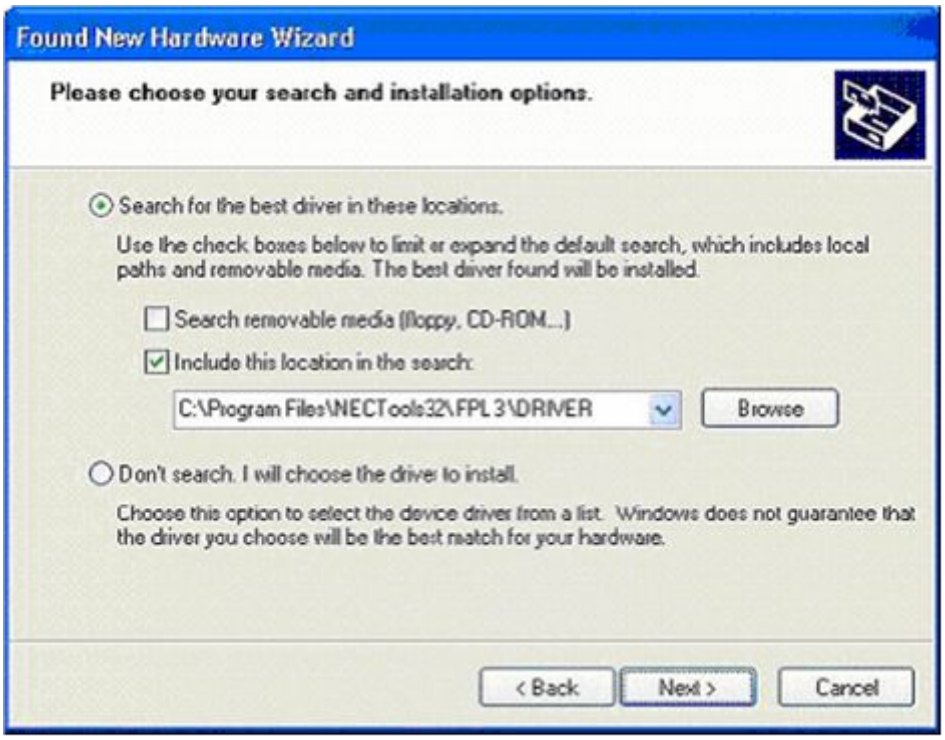

Found New Hardware Wizard
Please choose your search and installation options.
Search for the best driver in these locations.
Use the check boxes below to limit or expand the default search, which includes local paths and removable media. The best driver found will be installed.
Search removable media (floppy, CD-ROM...)
Include this location in the search:
C:\Program Files\NECTools32\FPL3\DRIVER
Browse
Don't search. I will choose the driver to install.
Choose this option to select the device driver from a list. Windows does not guarantee that the driver you choose will be the best match for your hardware.
< Back
Next >
Cancel

Figure 7-14 Search Location 1 (Windows XP)

As shown below, "has not passed Windows Logo testing to verify its compatibility with Windows XP." is displayed. Click Continue anyway.

Hardware Installation
The software you are installing for this hardware:
USB High Speed Serial Converter
has not passed Windows Logo testing to verify its compatibility with Windows XP. (Tell me why this testing is important.)
Continuing your installation of this software may impair or destabilize the correct operation of your system either immediately or in the future. Microsoft strongly recommends that you stop this installation now and contact the hardware vendor for software that has passed Windows Logo testing.
Continue Anyway
STOP Installation

Figure 7-15 Windows XP Logo Testing 1 (Windows XP)

When the window below is displayed, the installation of the USB driver is completed. Click Finish.

Found New Hardware Wizard
Completing the Found New Hardware Wizard
USB High Speed Serial Converter
Windows has finished installing the software for this device.
To close this wizard, cick Finish.
< Back
Finish
Cancel

Figure 7-16 USB Driver Installation Complete 1 (Windows XP)

Proceed to the installation of the USB Serial Port driver. Click Next >

Found New Hardware Wizard
Welcome to the Found New Hardware Wizard
This wizard helps you install software for:
USB Serial Port
If your hardware came with an installation CD or floppy disk, insert it now.
What do you want the wizard to do?
Install the software automatically (Recommended)
Install from a list or specific location (Advanced)
Click Next to continue.
< Back
Next >
Cancel

Figure 7-17 Found New Hardware Wizard 2 (Windows XP)

Check that "Search for the best driver in these locations." is selected. Check the "Include this location in the search:" check box and enter "C:\Program Files \NECTools32\FPL3\DRIVER", then click Next >

Found New Hardware Wizard
Please choose your search and installation options.
Search for the best driver in these locations.
Use the check boxes below to limit or expand the default search, which includes local paths and removable media. The best driver found will be installed.
Search removable media (floppy, CD-ROM...)
Include this location in the search:
C:\Program Files\NECTools32\ FPL 3 \DRIVER
Browse
Don't search. I will choose the driver to install.
Choose this option to select the device driver from a list. Windows does not guarantee that the driver you choose will be the best match for your hardware.
< Back
Next >
Cancel

Figure 7-18 Search Path 2 (Windows XP)

As shown below, "has not passed Windows Logo testing to verify its compatibility with Windows XP." is displayed. Click Continue anyway.

Hardware Installation
The software you are installing for this hardware:
USB Serial Port
has not passed Windows Logo testing to verify its compatibility with Windows XP. (Tell me why this testing is important.)
Continuing your installation of this software may impair or destabilize the correct operation of your system either immediately or in the future. Microsoft strongly recommends that you stop this installation now and contact the hardware vendor for software that has passed Windows Logo testing.
Continue Anyway
STOP Installation

Figure 7-19 Windows XP Logo Testing 2 (Windows XP)

When the window below is displayed, the installation of the USB driver is completed. Click Finish.

Figure 7-20 Hardware Installation Wizard Complete 2 (Windows XP)

Confirmation of USB Driver Installation

After installing the two types of drivers, check that the drivers have been installed normally, according to the procedure below. When using the *ZigBee™ development platforms!* board in combination with FPL3 GUI, the information to be checked here is needed.

By clicking the "Device Manager" tab, check that the drivers are installed normally.

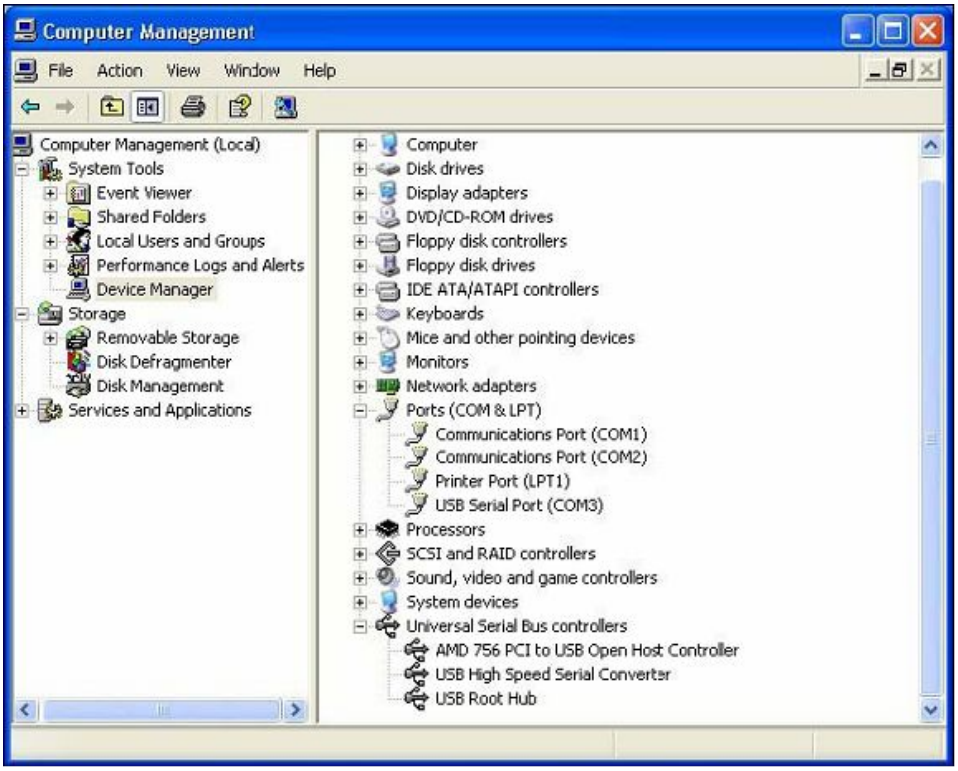


Figure 7-21 Device Manager

For Windows 2000/XP

Caution Do not perform "Hardware Modification Scan" when communicating with the target device.

Remark In the GUI port list box, the same communication port as COM? of USB Serial Port (COM?) needs to be selected.

Chapter 8 IAR Sample Session

8.1 Project Loading

When everything is set up correctly the IAR Embedded Workbench can be started. To do so, start the Embedded Workbench from Windows “Start” menu > “Programs” > folder “IAR Systems” > “IAR Embedded Workbench Kickstart for 78K”. The following screen appears:

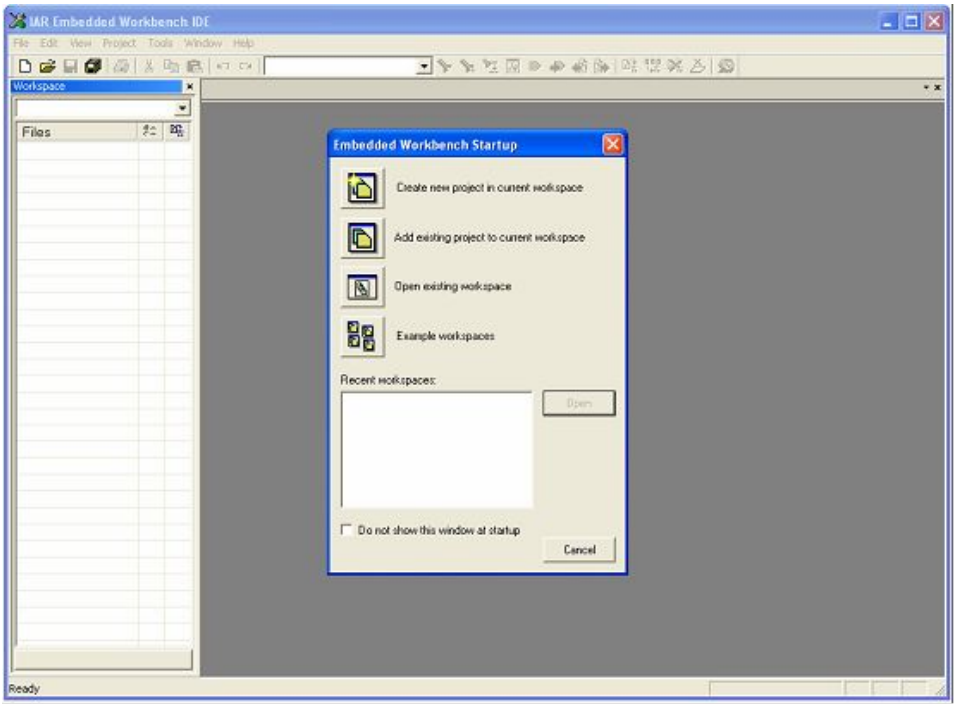


Figure 8-1 IAR Load Workspace

Now select the option “Open exiting workspace” from the “File” menu and locate the sample project. Open the file “UZ_78K0_TK_MAC.eww”. This is the workspace file that contains general information about the demo projects and corresponding settings. Various other sample project workspaces are available and the same procedure can be used for all of the sample workspaces.

After the sample project workspace has been opened a list of the available projects is available in the right hand window. Please select TK78K0KF2_Stack_Sample2 – Release project.

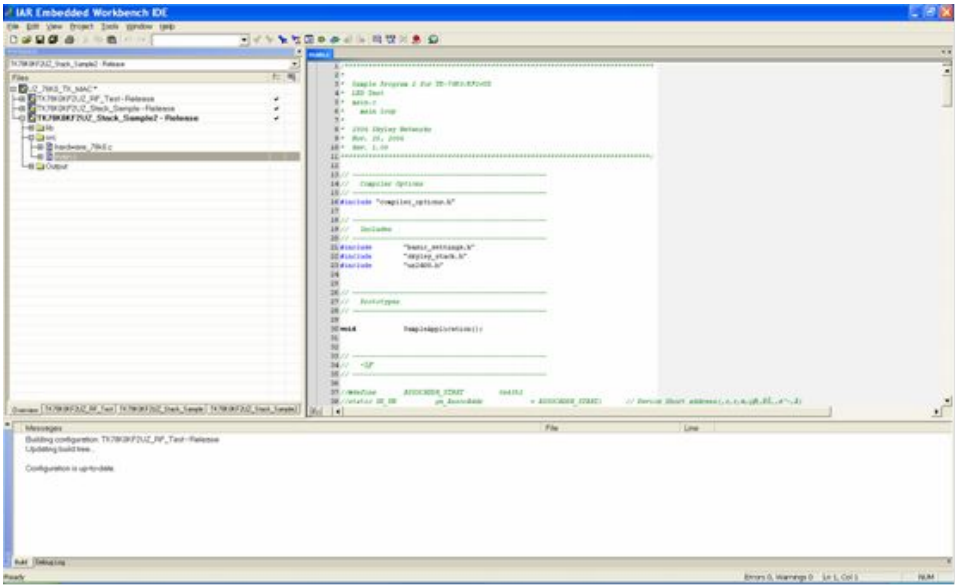


Figure 8-2 Load Sample WorkSpace

As a next step check some settings of the IAR Embedded Workbench that have to be made for correct operation and usage of the On-Board debug function of the TK-78K0/KF2+UZ board. First highlight the upper project folder called “TK78K0KF2_Stack_Sample2 – Release” in the workspace window. Then select “Project” > “Options” from the pull-down menus. Next select the category “Debugger”. Make sure that the driver is set to “TK-78” in order to use the On-Board debug function of the TK-78K0/KF2+UZ board. The device description file must be set to “io78f0547_80.ddf”. The corresponding COM port where the TK-78K0/KF2+UZ board is connected to the host PC will be detected automatically by the IAR C-SPY debugger.

8.2 Option Setting

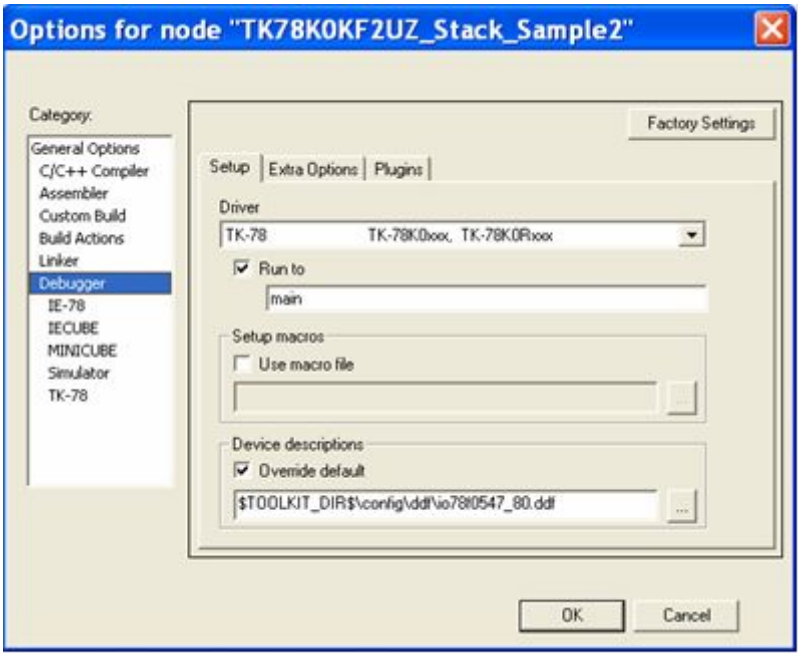


Figure 8-3 IAR Options Setting

Next the correct linker settings of the demo project will be checked. This can be done in the “Linker” category as shown below. Select the “Config” tab and check that the linker command file “lnk78f0547_80.xcl” is selected. This file is used by the linker and contains information on where to place the different sections of code, data and constants that may be used within the demo project:

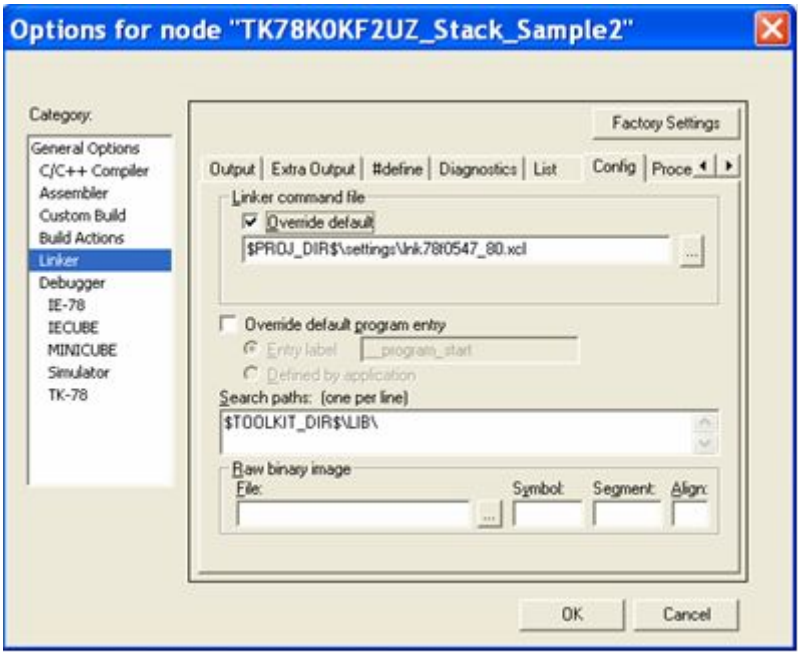


Figure 8-4 Linker Setting

Now after everything has been setup correctly it’s time to compile and link the demonstration project. Close the Options menu and select “Rebuild All” from the “Project” menu. If the project is compiled and linked without errors or warnings it can now be downloaded to the TK-78K0/KF2+UZ board and debugged.

8.3 Debugging

To start the IAR C-SPY debugger select the option “Debug” from the “Project” menu or press the “Debugger” button. In the next step the TK-78 Emulator has to be configured before downloading a new application. Press the OK button to enter the emulator hardware setup. Set the configuration as show in the figure below and start the download by pressing the OK button.

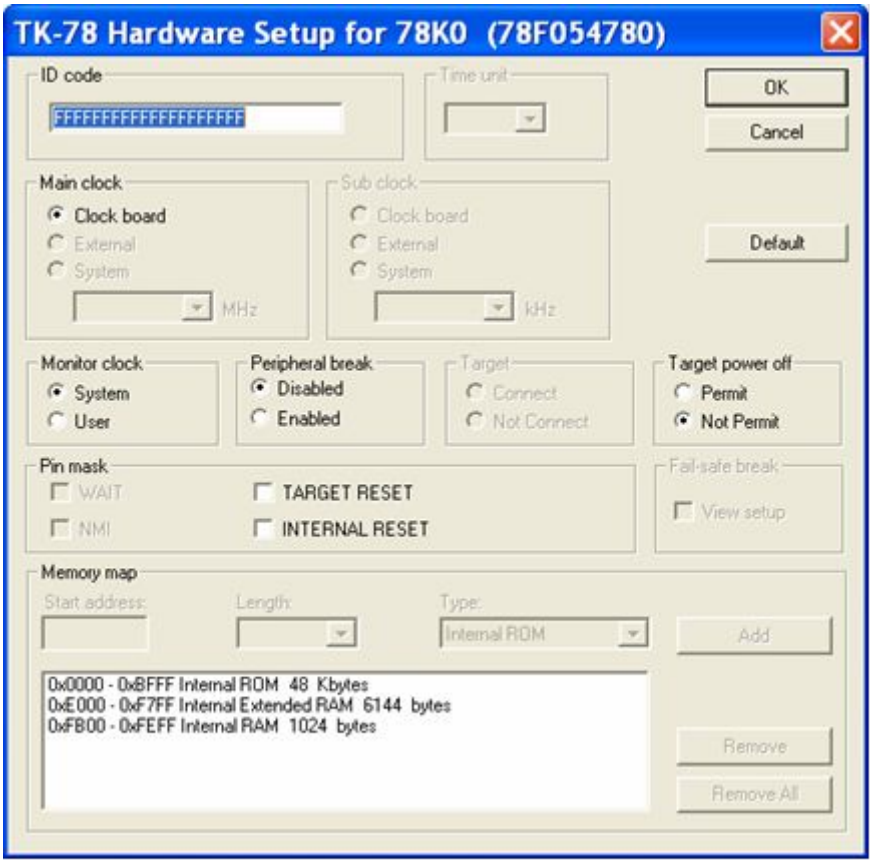


Figure 8-5 Hardware Setup Dialog

Now the debugger is started and the demo project is downloaded to the TK-78K0/KF2+UZ board. The progress of downloading is indicated by blue dots in the TK-78 Emulator window. Please note, downloading of larger executables can take some time.

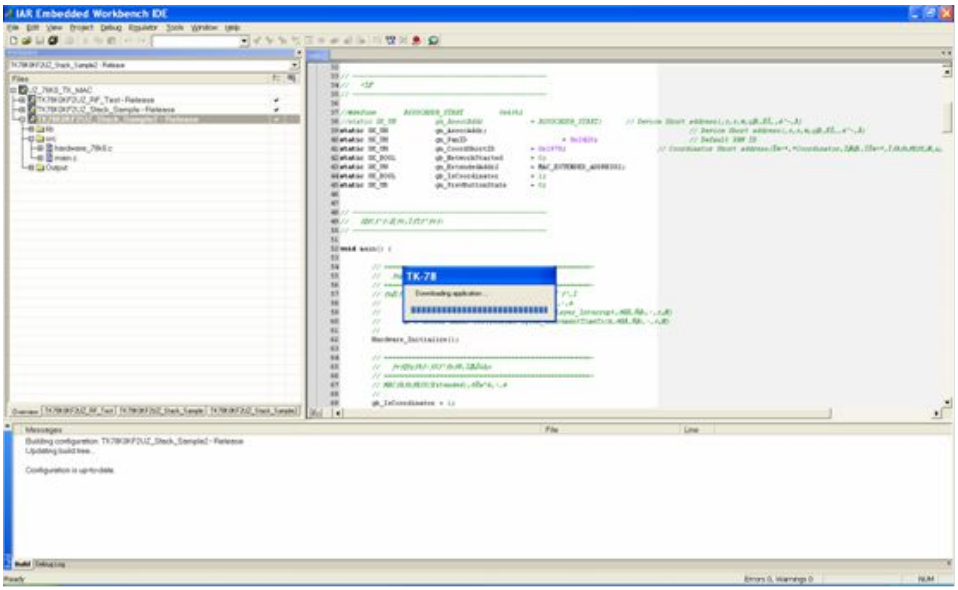


Figure 8-6 Download Sample Application

After the download was completed all debug features of IAR C-SPY debugger are available, i.e. Single Stepping, Step Over/-In/-Out, Go-Execution, Breakpoints, Register / Memory view etc.

To get more details on the debugger configuration and capabilities please refer to the “78K IAR Embedded Workbench IDE User Guide” of the IAR installation.

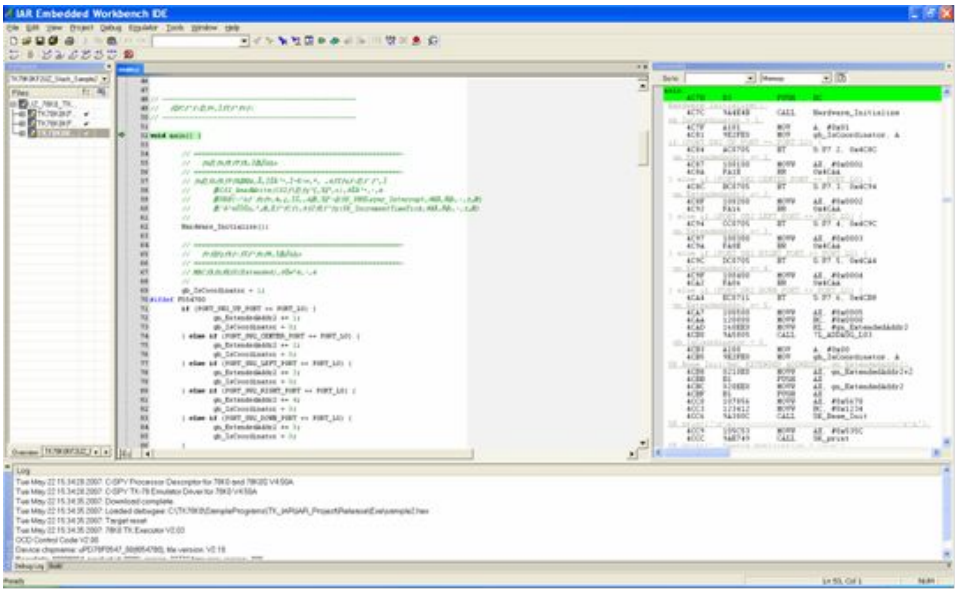


Figure 8-7 C-Spy Debugger

Chapter 9 Sample Programs

The following section provides a brief overview of the operation of the sample programs provided. It is recommended that the reader familiarises themselves with the MAC Library Reference Manual to fully understand the operation and usage of the library.

9.1 Initialisation

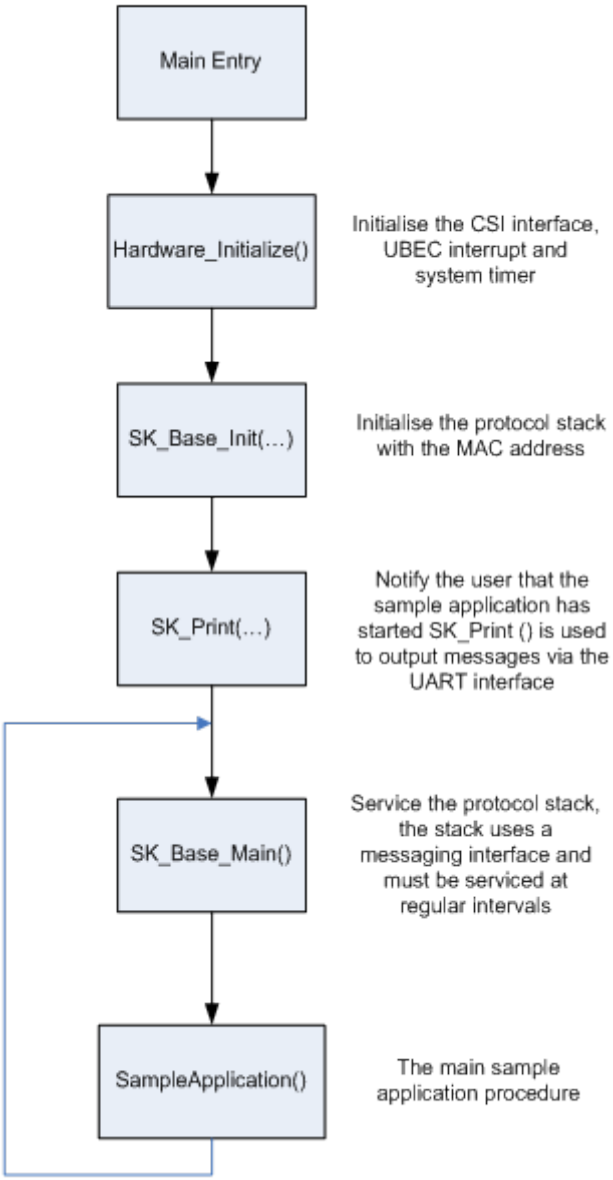

Main Entry
Hardware_Initialize()
Initialise the CSI interface, UBEC interrupt and system timer
SK_Base_Init(…)
Initialise the protocol stack with the MAC address
SK_Print(…)
Notify the user that the sample application has started SK_Print () is used to output messages via the UART interface
SK_Base_Main()
Service the protocol stack, the stack uses a messaging interface and must be serviced at regular intervals
SampleApplication()
The main sample application procedure

Figure 9-1 Flow Chart 1 Initialization

The above shows the main program initialisation and entry points for the text chat sample application.

The main part of the program is the SampleApplication() procedure, the elements of this process are:
Servicing the SK_LAYER_API for messages.
Managing and actioning of the user interface.

9.2 Servicing the SK_LAYER_API

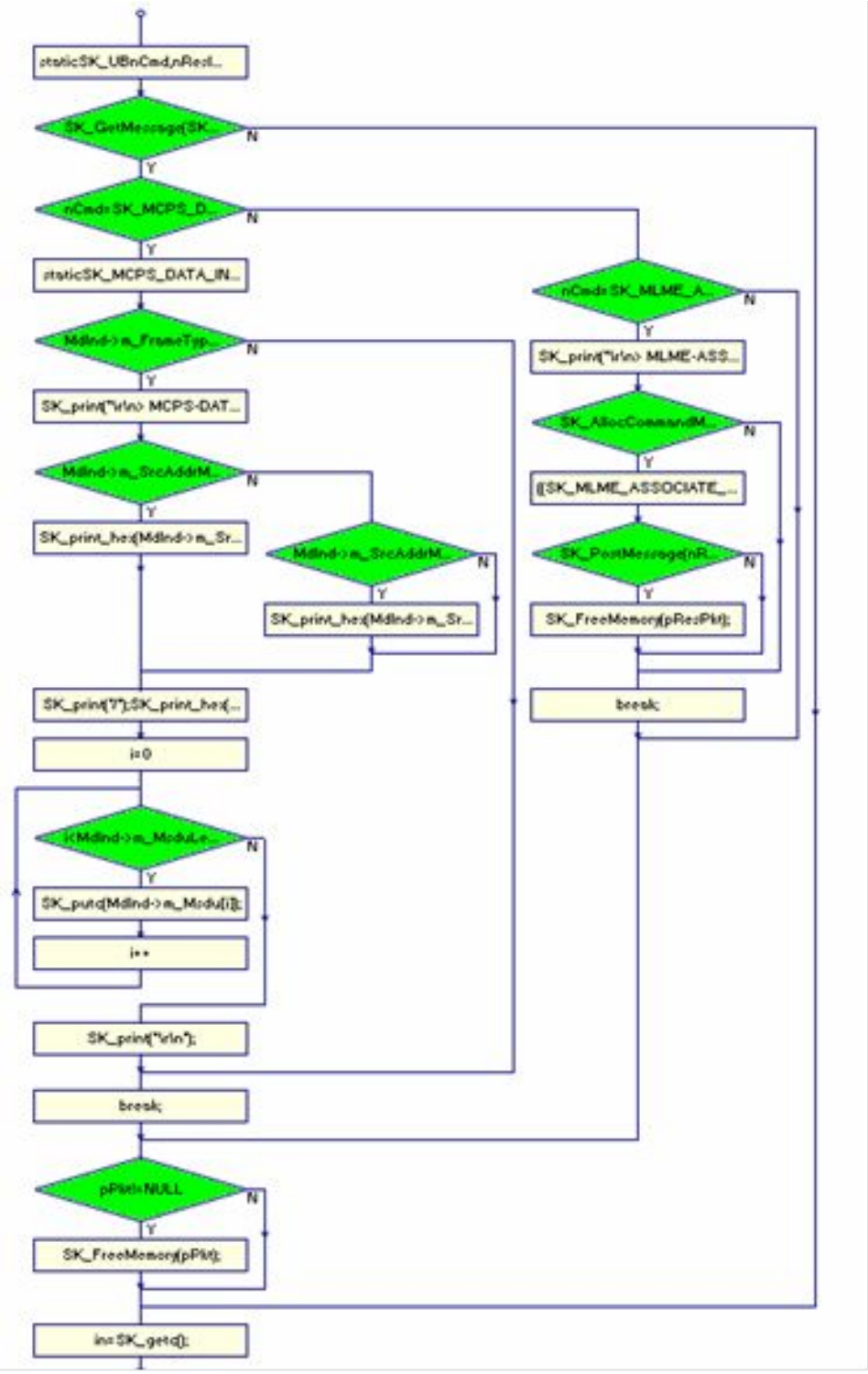


Figure 9-2 Flow Chart 2 API Management

The above flow chart shows the message processing of the API layer, the procedure SK_GetMessage is used to determine the relevant command state and also provides a pointer to any received packet data.

See the Mac library reference manual for detailed explanations of the MAC commands and API processing functions.

9.3 Managing and Actioning the User Interface

The remainder of the procedure reads characters from the user interface and acts as a command parser. The command parser will decode the characters and process them so that the correct menu commands and relevant API calls are issued.

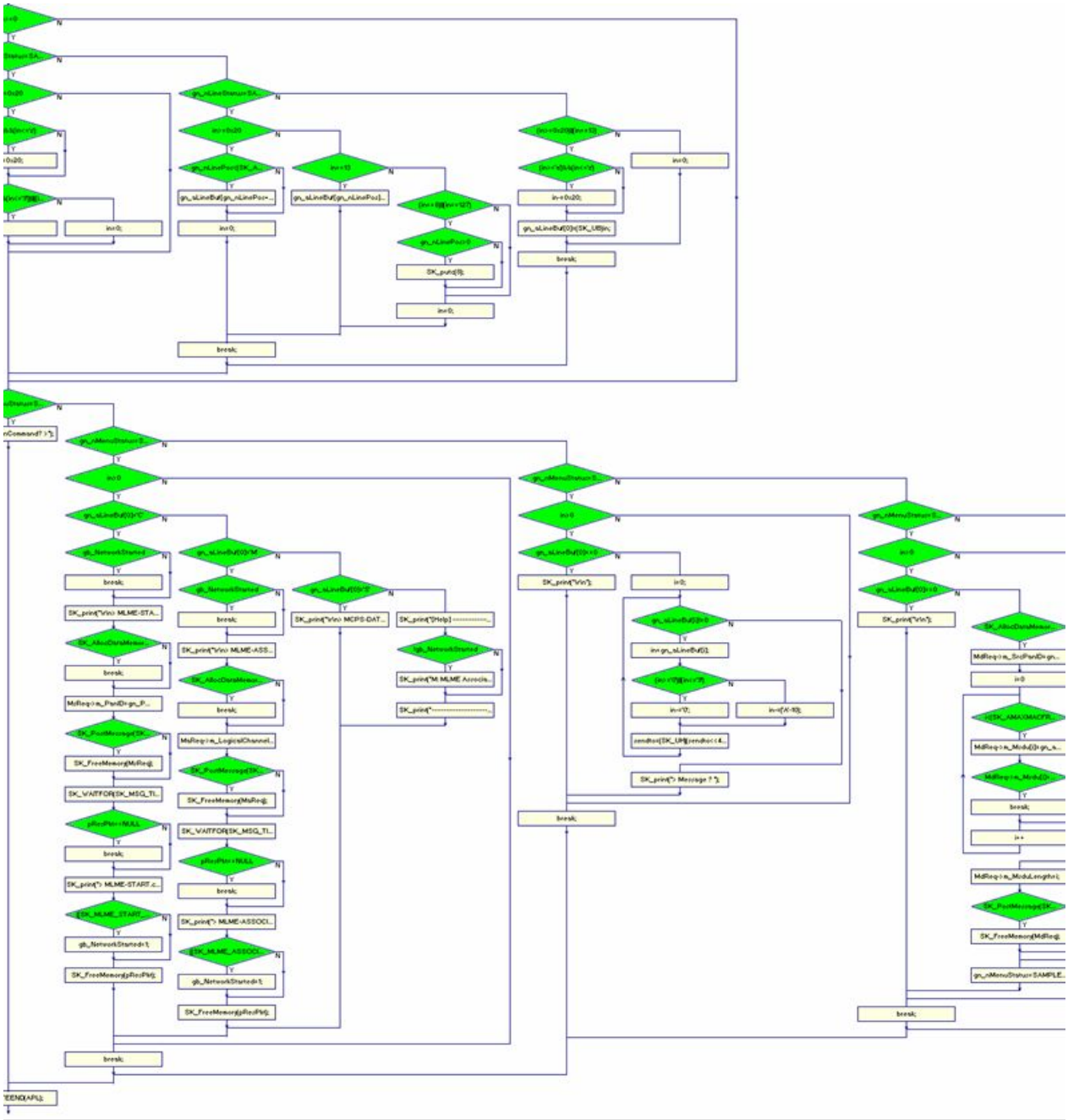
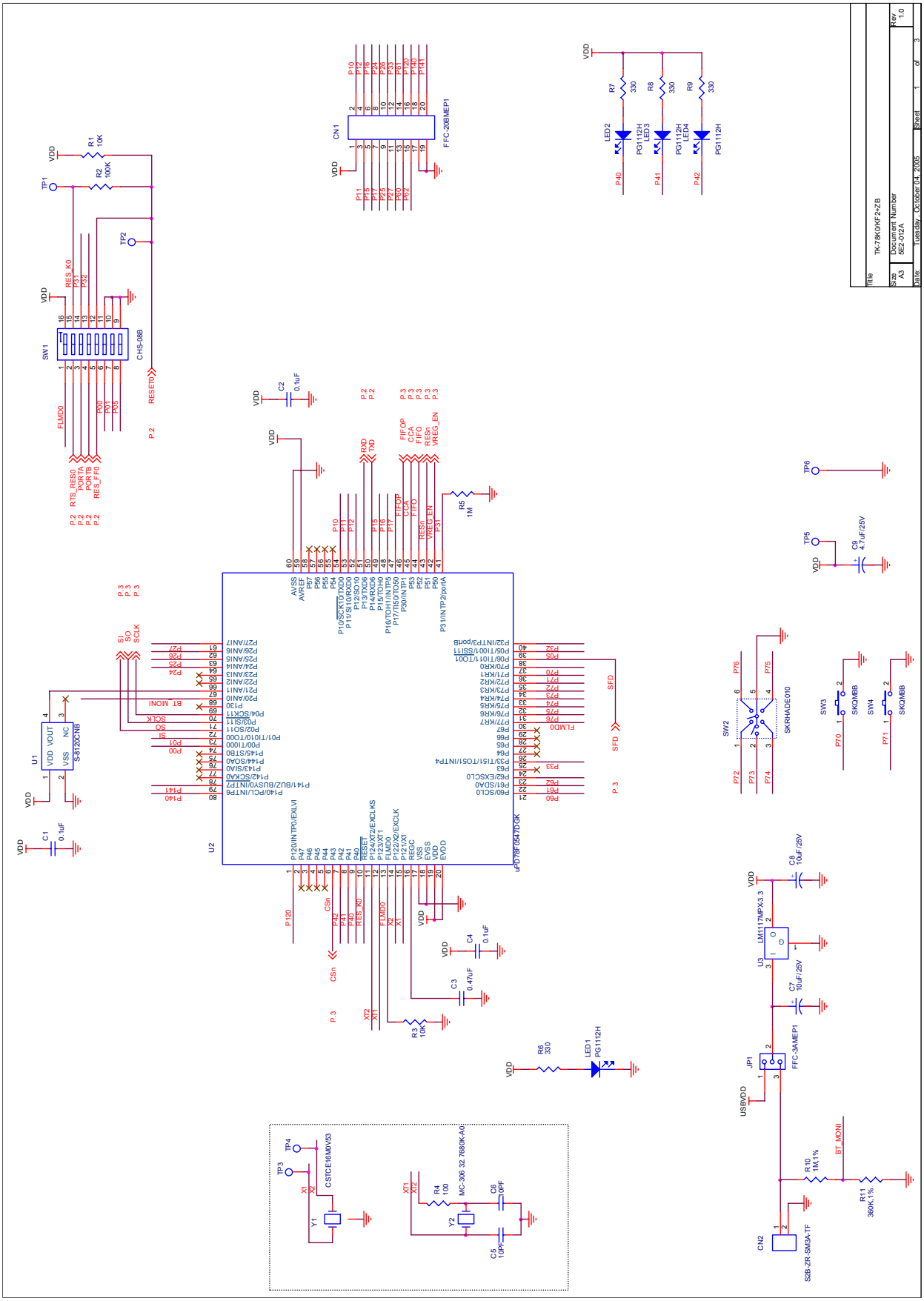
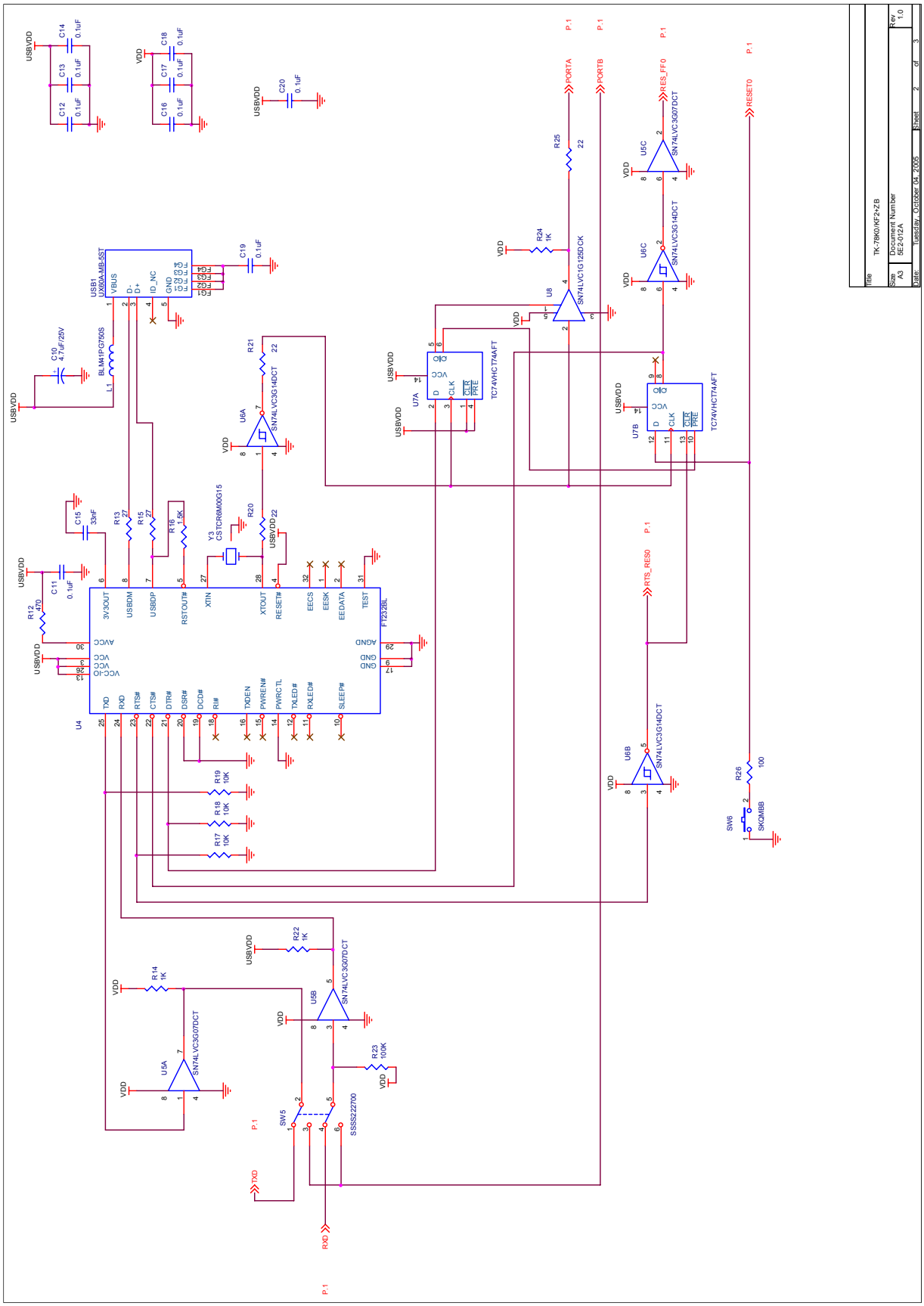


Figure 9-3 Flow Chart 3 Command Parser

Chapter 10 Schematic Diagrams TK-78K0/KF2-UZ

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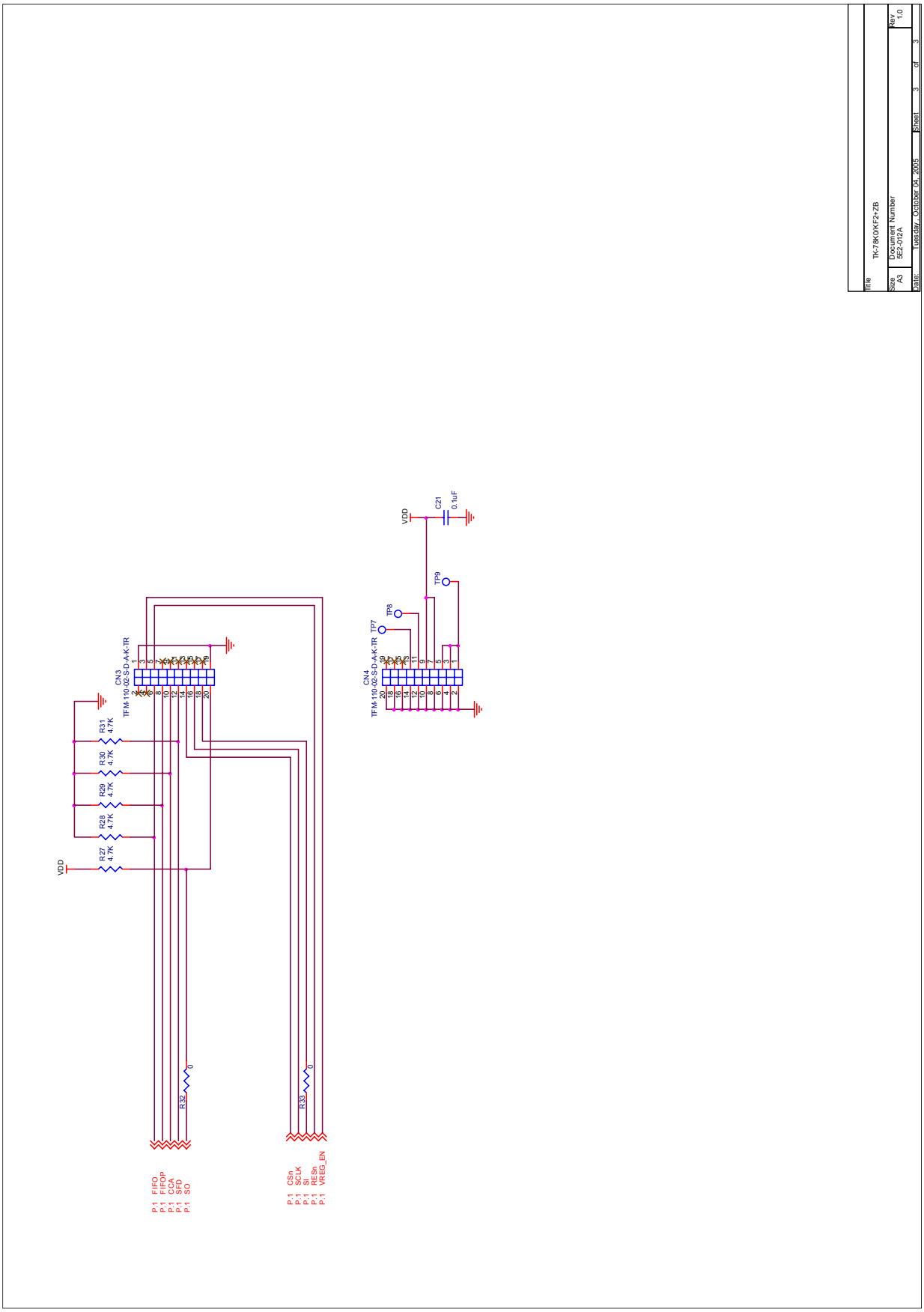
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P.1 CCA
P.1 SFD
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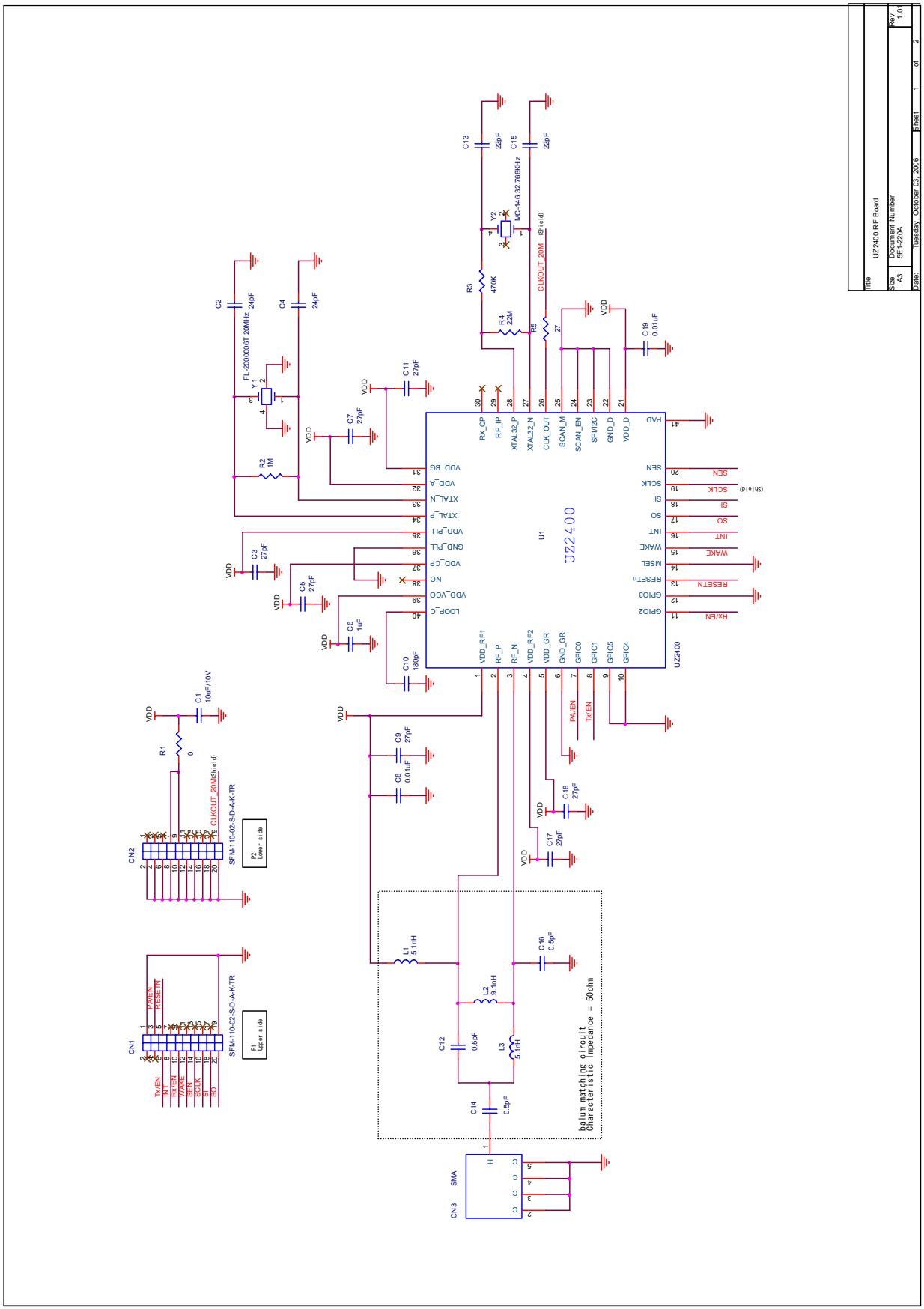
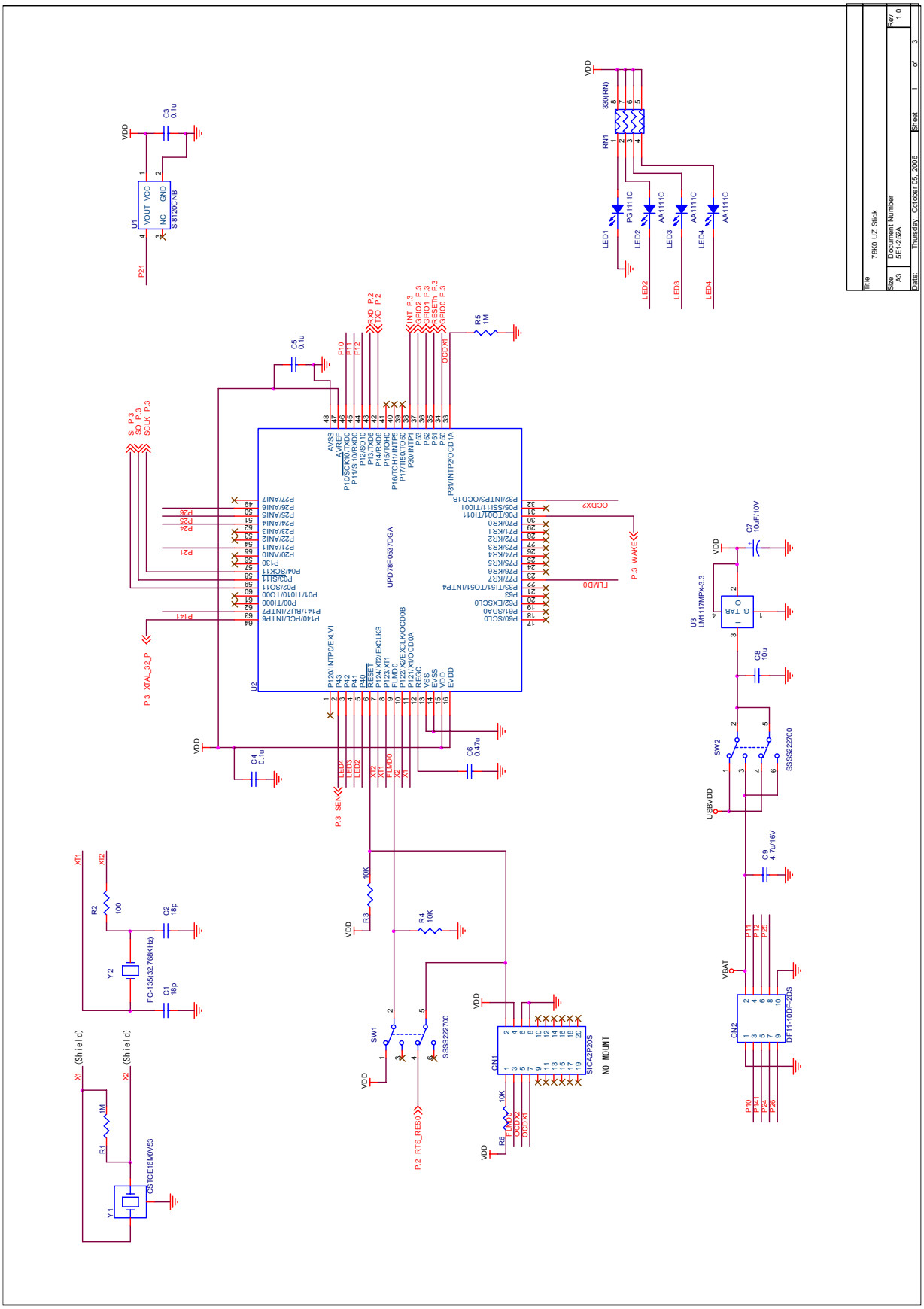
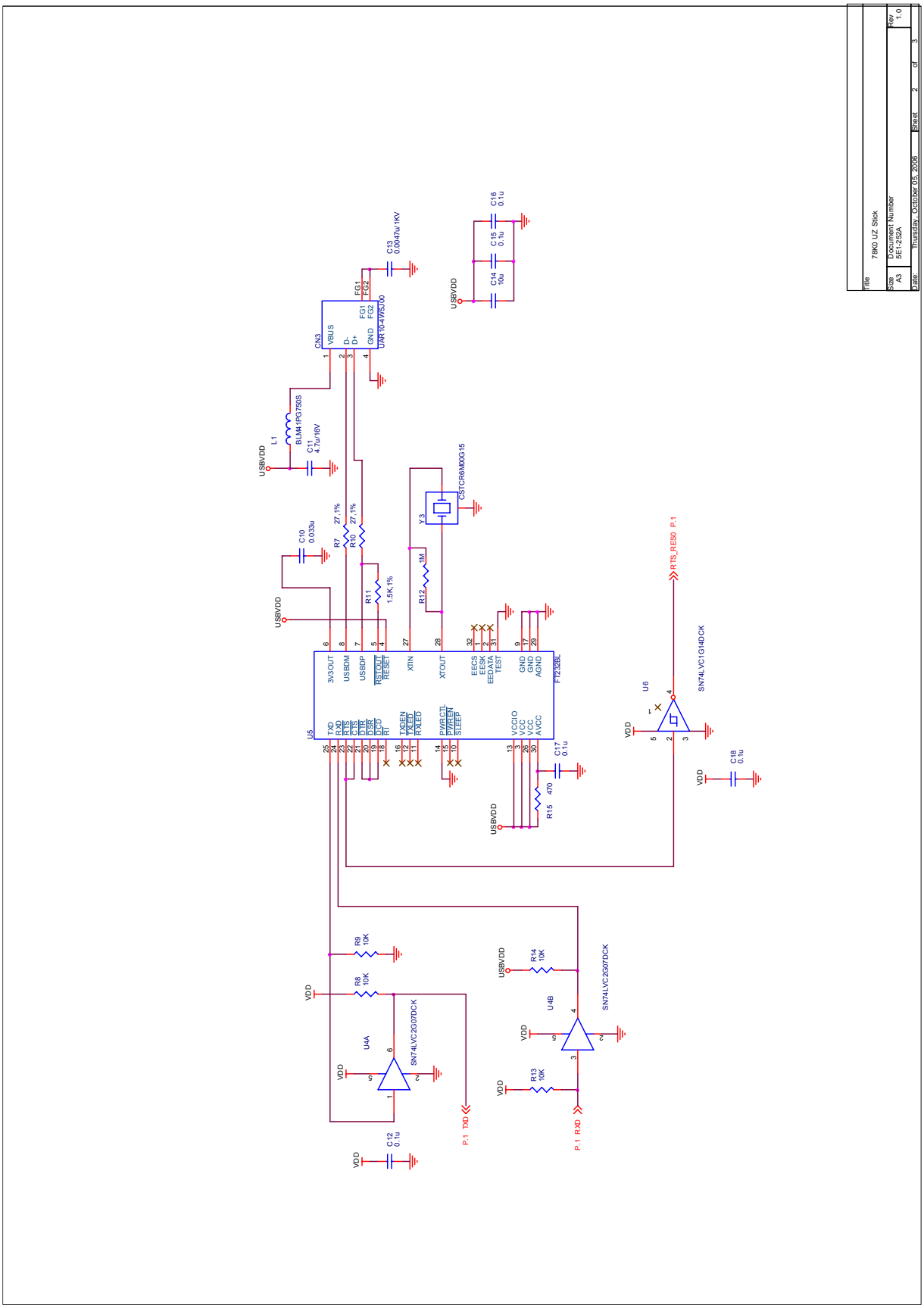
P.1 RESn
P.1 VREG_EN

10.1 Circuit Diagram of UZ2400 RF board



Chapter 11 Schematic Diagrams 78K0 UZ Stick

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FG2
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BLM41PG750S
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R7 27.1%
R10 27.1%
R11 1.5K,1%
R12 1M
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CSTCR6M00G15
U5
3V3OUT
USBDM
USBDP
RSTOUT
RESET
XTIN
XTOUT
EECS
EESK
EEDATA
TEST
GND
GND
AGND
F12328
TXD
RXD
RTS
CTS
DTR
DSR
DCD
RI
TXDEN
TXLED
RXLED
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PWREN
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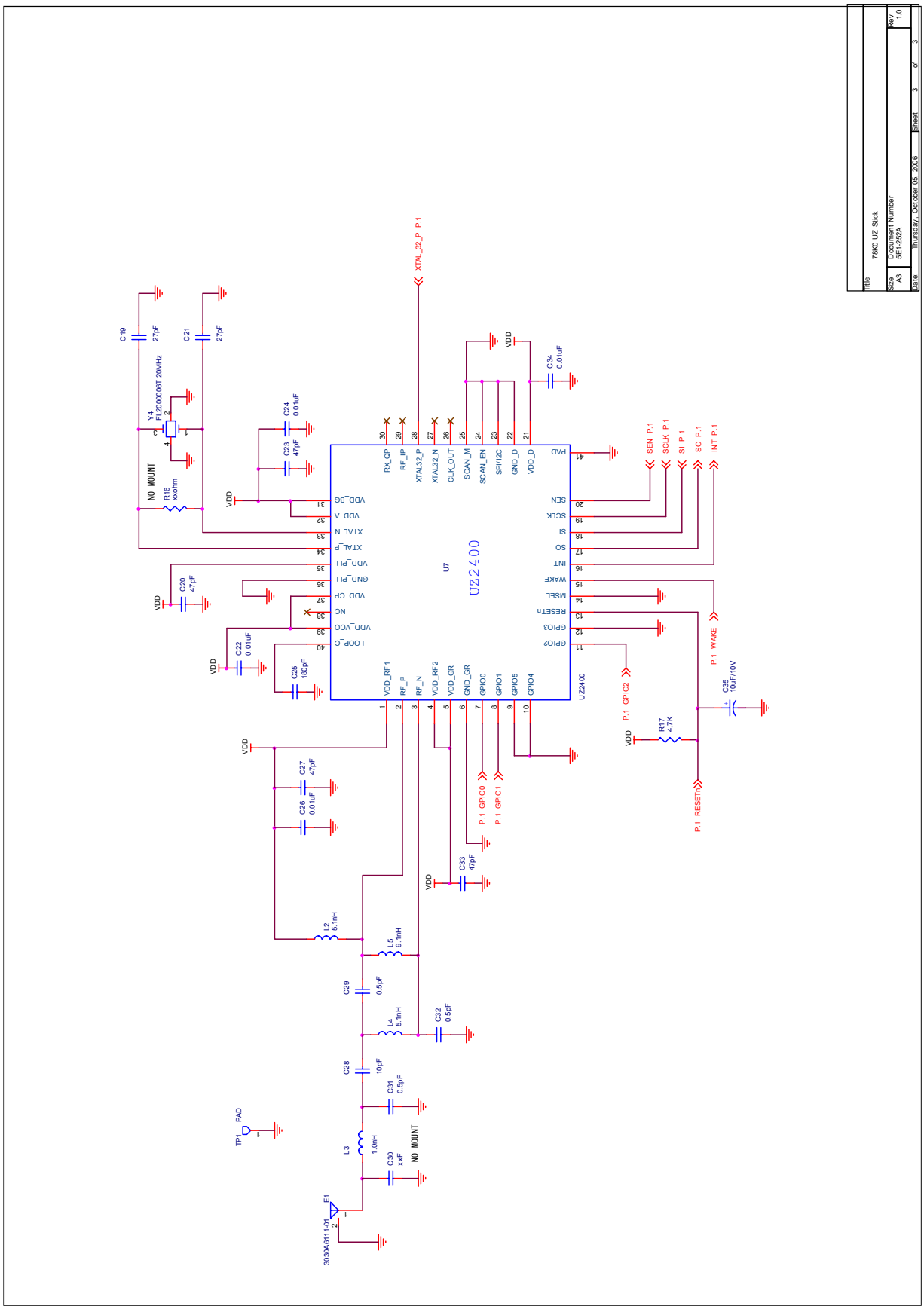
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